PATENTED

CONTRAFLO

"SUPER-ECONOMIC" BOILER

DANKS OF NETHERTON LTD

NETHERTON · DUDLEY · WORCS

ENGLAND

Telephones :
Cradley Heath 6217 (3 lines)

Telegrams : "Danks Dudley Worcs."
Code : A.B.C. 5th Edition

DANKS OF NETHERTON LIMITED

ESTABLISHED 1840

Boiler Makers and Engineers

NETHERTON · DUDLEY · WORCS

ENGLAND

Specialists in the

BUILDING OF BOILER AND ECONOMISER SETTINGS
CHIMNEYS · BOILER HOUSES · ETC.

London	Bank Chambers, 329 High Holborn, W.C.1	Holborn 2065
Manchester	22 Bridge Street, Manchester	Blackfriars 1991
Swansea	New Cut Road, Swansea	Swansea 3106
Newcastle upon Tyne	2 Simpson Street, Newcastle upon Tyne	Newcastle upon Tyne 26295

Agencies in

British West Indies · Burma · Middle East · New Zealand · South Africa · Turkey · Uruguay & Chile

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Contractors to the Admiralty, War Office and other Government Departments

OUR PRODUCTS

SHELL BOILERS :

Lancashire, flat and dished end boilers.

Cornish, flat and dished end boilers.

Cylindrical multi-tubular boilers.

Economic boilers—self-contained and brick-set.

Super-economic boilers (pat. Nos. 429, 383 and 475,031).

Riveted or Welded Construction.

COMPLETE BOILER PLANT INSTALLATIONS, including :

Superheaters.

Mechanical stokers and oil firing equipment.

Coal elevators, conveyors and steel bunkers.

Ash handling plant.

Economisers, induced draught fans, pipework, pumps, etc.

BUILDING DEPARTMENT :

Boiler and economiser settings.

Brick chimneys—circular, square, or octagonal.

Complete boiler houses.

Refractory construction.

TANK AND CONSTRUCTIONAL DEPARTMENT :

Self-supporting and guyed chimneys.

Tanks—cylindrical and rectangular—mild steel and stainless steel.

Gas and water pipes.

Air and gas receivers.

Vulcanising cylinders.

Steam jacketed pans, mild steel and stainless steel.

Coal and ash bunkers.

General platework.

WELDING AND X-RAY DEPARTMENT :

All types of welded pressure vessels for chemical and oil industries including vessels to Lloyd's Class I requirements.

OUTWORK DEPARTMENT :

Lancashire, Cornish and other types of boilers equipped with new flues and furnaces, belts, etc.

General Boiler repairs.

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FOREWORD

We are, quite naturally, proud of our 115 years' record of boiler making and, in particular, of our Contraflo "Super-Economic" Boiler (Patent Nos. 429,383 and 475,031), first introduced by us in 1934. During this 22 years, the sound technical principles of its design have been fully demonstrated.

Some thousands of these self-contained boilers have been installed for power, high or low pressure heating and process work, and they are installed in Public Buildings, Hospitals, Motor Car and Aircraft Factories, Chemical Works, Textile Factories, Dye Works, Laundries and Flats. Proved reliability and high efficiency has been achieved.

The continued high cost of fuel focuses attention even more sharply on the thermal efficiency of boilers and provides a keen incentive to the purchaser to install plant which will, by its superior performance, generate steam at the lowest possible cost.

An average boiler, in one year, will burn fuel costing 30% more than the price of the boiler, so it is evident that any small differences in initial cost of the plant has an insignificant effect on the cost of steam production. On the other hand, the superior thermal efficiency of the "Super-Economic" boiler will provide a saving equivalent to some 14% of the purchase price of the boiler *every year*, and the more the boiler is worked, and the higher the price of fuel, the greater will be the proportionate saving.

Our boilers have been liberally designed to cope with the lower grade fuels, the low combustion rates and large radiant heating surfaces resulting in minimum maintenance and a capacity for continuous rating day in and day out. Boilers of this type have worked non-stop over the whole period between the statutory inspections.

The installation of a "Super-Economic" boiler means low capital cost, lower maintenance, and substantial fuel saving.

We offer a comprehensive service to prospective customers. We employ our own Civil Engineering Staff, and can provide an entirely complete boiler plant ; that is, we survey the site, provide foundations, buildings, brick or steel chimneys, boilers, auxiliaries, analyse, check and test fuel and water supplies, and provide plant for handling and treatment. All the above delivered, installed and set to work, with instructions to boilerhouse staff, and a first-class after-sales service.

In the subsequent pages of this catalogue we give a description of the boiler, list of sizes and duties, and general specification of construction, together with illustrations and descriptions of a few of the plants we have had the pleasure of supplying.

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A BRIEF LIST OF SOME OF THE USERS OF THE PATENT "SUPER-ECONOMIC" BOILER

Aero Research Limited.
Allen West & Co. Ltd.
Ardkeen Sanatorium.
Ashchurch Vehicle Depot.
Ashmore, Benson, Pease & Co.
Associated Laundries Ltd.
Atomic Energy Depts.

B.S.A. Tools Ltd.
Bank of England.
Beach, T. W., & Son Ltd.
Belling & Co. Ltd.
Berkeley Square House.
Birkenhead Technical College.
Birmingham General Hospital.
Birmingham Public Works Department (Duddeston & Nechells Flats).
Blackpool Pleasure Beach.
British Insulated Callender's Cables Ltd.
British Lion Film Studios Ltd.
British Oxygen Co. Ltd.

C.A.V. Limited.

Davis Gas Stove Co. Ltd.
De Havilland Engine Co. Ltd.
Dickins & Jones Ltd.
Dickinson, John, & Co. Ltd.
Dunlop Rubber Co. Ltd.
Durham Colleges.

Emergency Hospital, Southport.
Epsom County Hospital.

Fisher & Ludlow Ltd.

General Motors Limited.
Gloster Aircraft Ltd.
Guest, Keen & Nettlefolds Ltd.
Guildhall, Nottingham.

Halifax General Hospital.
Hoffmann Manufacturing Co. Ltd.
Hoover Ltd.

Irish Hospitals Trust.

Jenson & Nicholson Ltd.
Johnson & Phillips Ltd.

K. & L. Steelfounders & Engineers Ltd.
Keith Blackman Ltd.

Lewis's Limited.
Lloyd, Richard, & Sons Ltd.
London Transport Executive.
Lucas, Joseph, Limited.

Main, R. & A., Limited.
McVitie & Price Ltd.
Metal Box Co. Ltd.
Murphy Radio Ltd.
Murray Tobacco Co. Ltd.

National Cash Register Co. Ltd.
National Coal Board.

Papworth and Enham Industries.
Pressed Steel Co. Ltd.
Pritchett & Gold and E.P.S. Co. Ltd.

Qualcast Limited.

Reading Technical College.
Richards Tiles Ltd.
Rolls-Royce Ltd.
Rootes Securities Ltd.
Rover Co. Ltd.
Royal Manchester Children's Hospital, Pendlebury.
Royal Ordnance Factories at Nottingham, Leeds, Dalmuir and Ranskill.

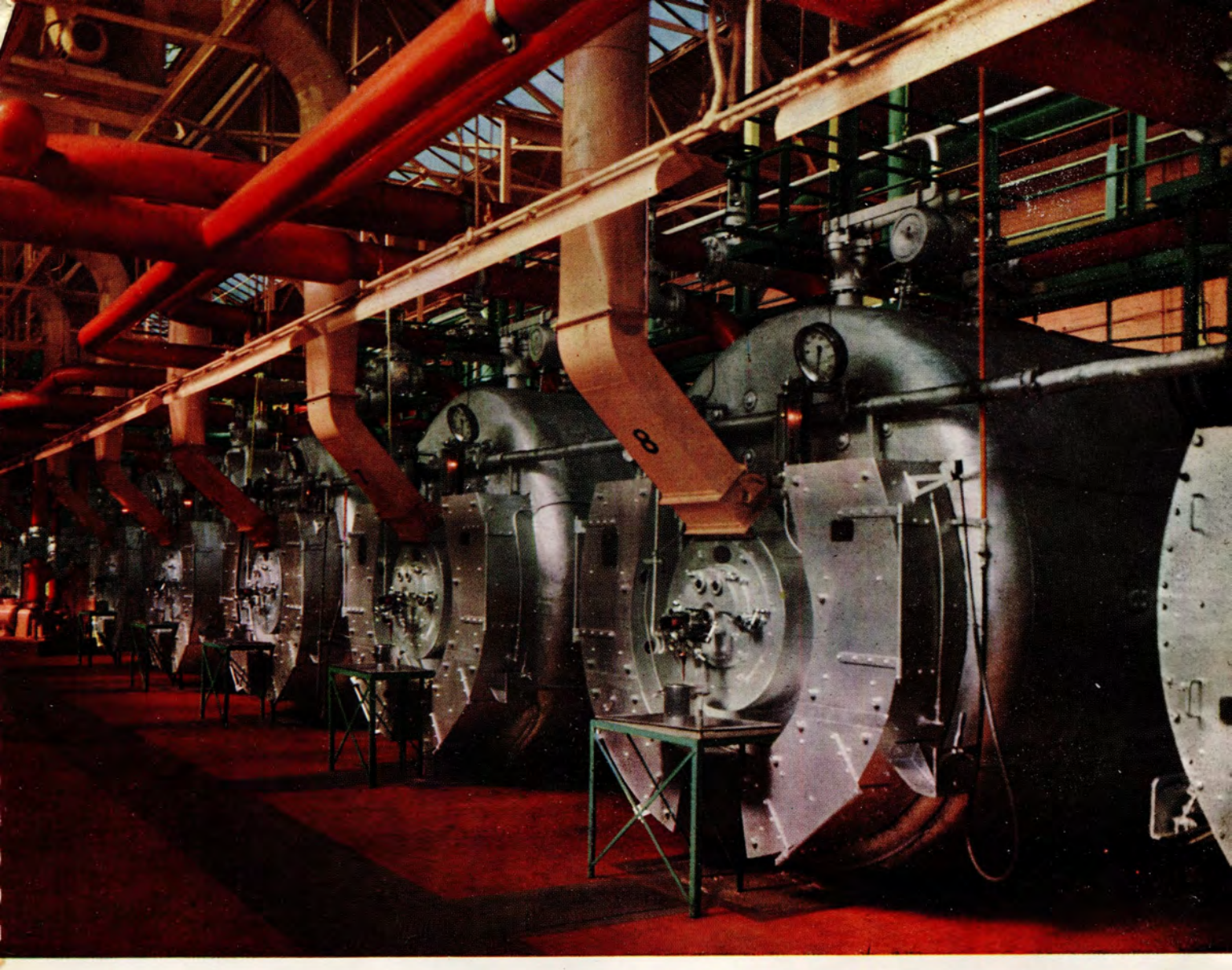
Sankey, Joseph, & Sons Ltd.
St. Catherine's Colony, Doncaster.
St. Helier Hospital, Carshalton.
Smedleys Ltd.
Southern United Telephone Cables Ltd.
Spillers Limited.
Standard Motor Co. Ltd.
Steel Company of Wales Ltd.

Technicolor Limited.

Universal Grinding Wheel Co. Ltd.

Vickers-Armstrongs Ltd.

Walton & Brown Ltd.
Warren Road Hospital, Guildford.
Wedgwood, Josiah, & Sons Ltd.
Williams (Hounslow) Ltd.
Wrexham Technical College.



A BATTERY OF "SUPER-ECONOMIC" BOILERS FOR HIGH PRESSURE HOT WATER HEATING INSTALLED AT :—

STANDARD MOTOR CO. LTD.,
CANLEY WORKS, COVENTRY.

Heating Engineers :
CARRIER ENGINEERING CO. LTD.,
LONDON.

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THE PRINCIPLE OF THE
"SUPER-ECONOMIC" BOILER

The "Super-Economic" Contraflo Boiler, Patent Nos. 429,383 and 475,031, does not differ in its fundamental construction from what is known as the ordinary or standard Economic Boiler, but it does differ substantially in the arrangement of the furnace flue(s) and heating surface.

We have incorporated in the design of this boiler all the practical experience (our own and other peoples) gained during over a century in the industry. In the ordinary, or standard, Double Pass Economic Boiler, the products of combustion leaving the main furnace flue(s) pass upward through a series of small tubes situated above the furnace, and then pass out to the chimney. In the Standard Treble Pass Economic Boiler, the gases leaving the main furnace flue make two passes through the boiler before going to the chimney, and in the Brick-Set Economic, the gases leaving the main furnace flue pass through a series of tubes situated above the furnace, and then pass around the shell of the boiler before going to the chimney.

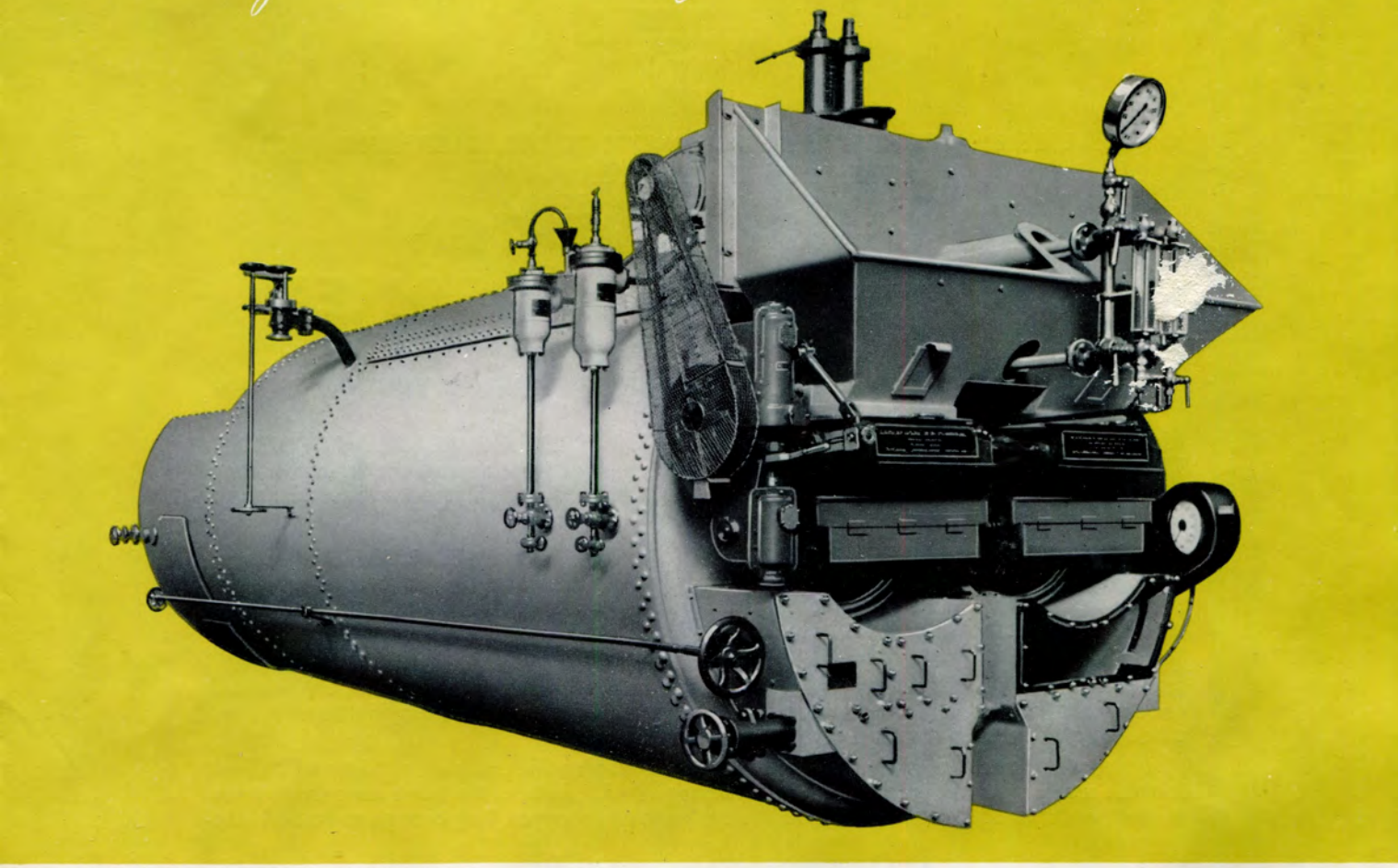
All the above three types of Economic Boilers suffer from the disadvantage that the gases become progressively cooler—*far too slowly*—in their passage through the boiler tubes because these are located in the high temperature water area above the boiler furnace flue(s) giving low gas-to-water heat transfer with a consequent loss of valuable heat up the chimney.

In our patented "Super-Economic" Boiler a unique contraflo heat transfer system is employed. The gases in their *triple* passage pass firstly through the furnace flue(s), back through tubes below high temperature water area and thirdly through tubes in the bottom cool water region of the boiler thus giving maximum heat transfer and imparting a vigorous circulation in what is in the other types a stagnant water area, resulting in much lower stack temperatures with consequent improved efficiency ; and the drawing on page 9 illustrates our patented design using this system.

Around this basic principle we have designed a Self-Contained Boiler having a high ratio of heating surface exposed to radiant heat, ample grate area, volume and time factor for the combustion of fuel, refractory lining surfaces for smoke elimination and high gas speeds in the gas tubes creating the turbulence essential for rapid heat transfer.

The gas passages are made completely air- and gas-tight by steel casings and the access and cleaning doors are securely bolted on to asbestos seals. The combustion efficiency is thereby maintained and in conjunction with the high heat transfer rate produces the remarkable results for which our "Super-Economic" Boiler has become so well known.

The "Super-Economic" Boiler has the approval of every leading Insurance Company and we are always pleased to give facilities for our customers to examine their boilers during construction and test.



The "SUPER-ECONOMIC" BOILER will give higher efficiencies than any other self-contained type boiler, many installations working with an efficiency of 80% and over. Consequently, it will show a substantial saving on the annual fuel bill.

The "SUPER-ECONOMIC" BOILER, being of the self-contained type, requires no external brickwork. Therefore, it costs less to install and saves money on the annual overhaul because there is no external brickwork to maintain.

The "SUPER-ECONOMIC" BOILER can be arranged with Mechanical Stokers, Oil Firing Equipment or special furnaces for timber waste, bagasse, flax, refuse or peat. Also with gas burners for burning town gas, blast furnace gas, etc., or combination of gas and oil.

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The ENTIRE ACCESSIBILITY FOR INSPECTION, CLEANING AND ATTENDANCE GENERALLY of the

DANKS-NETHERTON "SUPER-ECONOMIC" BOILER

Patent No. 429,383 and 475,031

will be seen on reference to Diagram and Photographs on following pages and from the following notes.

1. THE TOP AND SIDES OF FURNACE FLUE OR FLUES ARE READILY ACCESSIBLE FOR CLEANING. As about 65% of the evaporation takes place around the furnace flue or flues, it will be appreciated how important this accessibility is, and what an immense advantage the boiler has in this respect.

2. NONE OF THE SMOKE TUBES ARE BEHIND THE HOPPER OR HOPPERS, thus permitting of the cleaning of all the tubes by merely opening the smoke box doors provided. Where mechanical Soot Blowing is not fitted and hand cleaning is applied this is a simple operation and can be carried out from floor level. The attendant has only to walk backwards and forwards to clean the whole length of the tubes.

In most other types of Economic Boiler, there are smoke tubes above the furnace or furnaces, and hoppers have to be removed before the tubes can be cleaned, in the larger sizes of boilers a ladder or platform is required to be used.

Many years of experience of these types of boilers has shown that the labour and time involved in these preparations causes the cleaning to be neglected. At best, the work can only be done at week-ends, or at other times when the boiler can be stopped long enough to remove the hoppers.

3. THERE BEING NO SMOKE TUBES IN THIS "SUPER-ECONOMIC" BOILER ABOVE THE FURNACE CROWNS, FUSIBLE PLUGS CAN BE EFFECTIVELY USED to protect against damage from low water, not only the furnaces, but also the smoke tubes, this adding greatly to the safety of the boiler. The safeguard of Fusible Plugs is absent from Economic Boilers with smoke tubes above the furnaces, these tubes becoming exposed to over heating before the Fusible Plugs come into operation.

4. In the SMALLER as well as the LARGER boilers of this PATENTED DESIGN, a manhole is provided to give access to the bottom of the boiler, allowing of inspection and cleaning of the lower part of the shell, furnaces and smoke tubes.

Single flued boilers of other types are rarely provided with manhole at bottom.

5. The manhole in the bottom of this boiler and the special arrangement of furnaces and smoke tubes allow of a man entering at the bottom of the boiler and getting out through the manhole on top of the boiler or *vice versa*.

6. The Induced Draught Fan and Motor can be placed at floor level, normally immediately behind the boiler, where they are readily accessible without climbing ladder, facilitating better attention. In cases where space is greatly restricted, the fan and motor can be placed on top of the combustion chamber as shown on opposite page.

7. The chimney can be placed outside the boiler house, avoiding what is frequently the cause of trouble, leakages between the chimney and roof.

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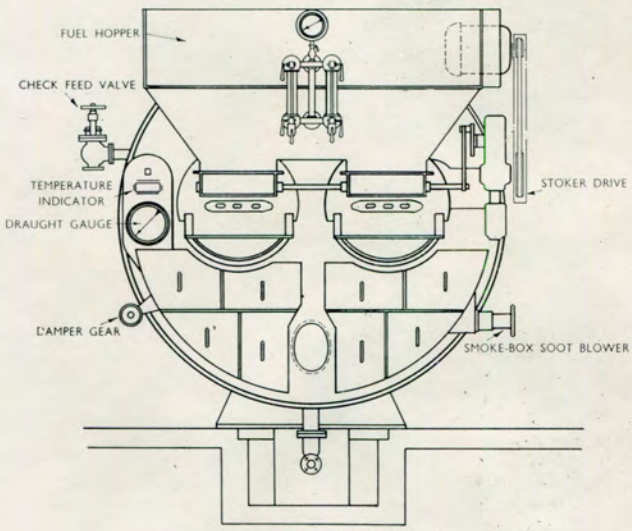
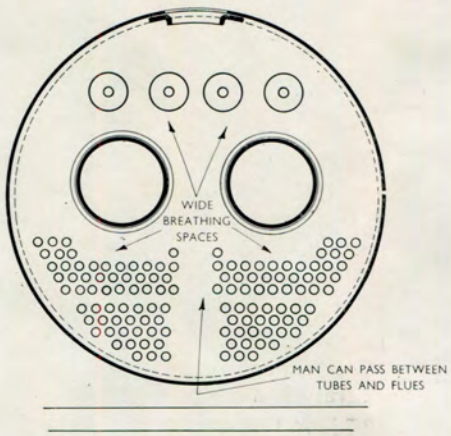
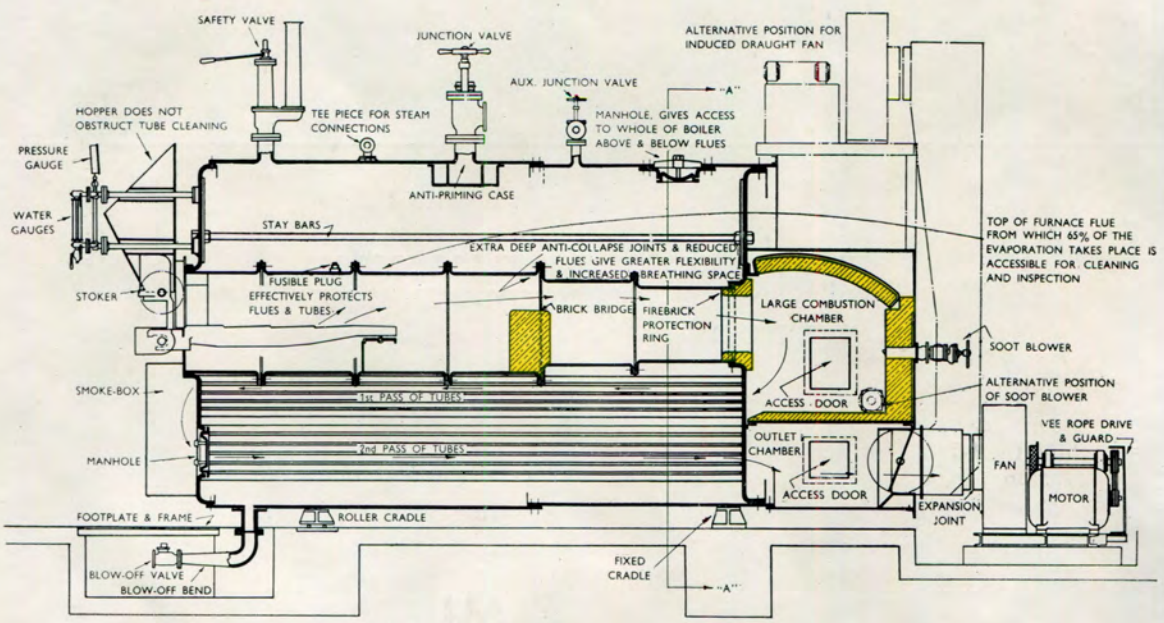
SECTIONAL DRAWING OF "SUPER-ECONOMIC" BOILER



FRONT ELEVATION

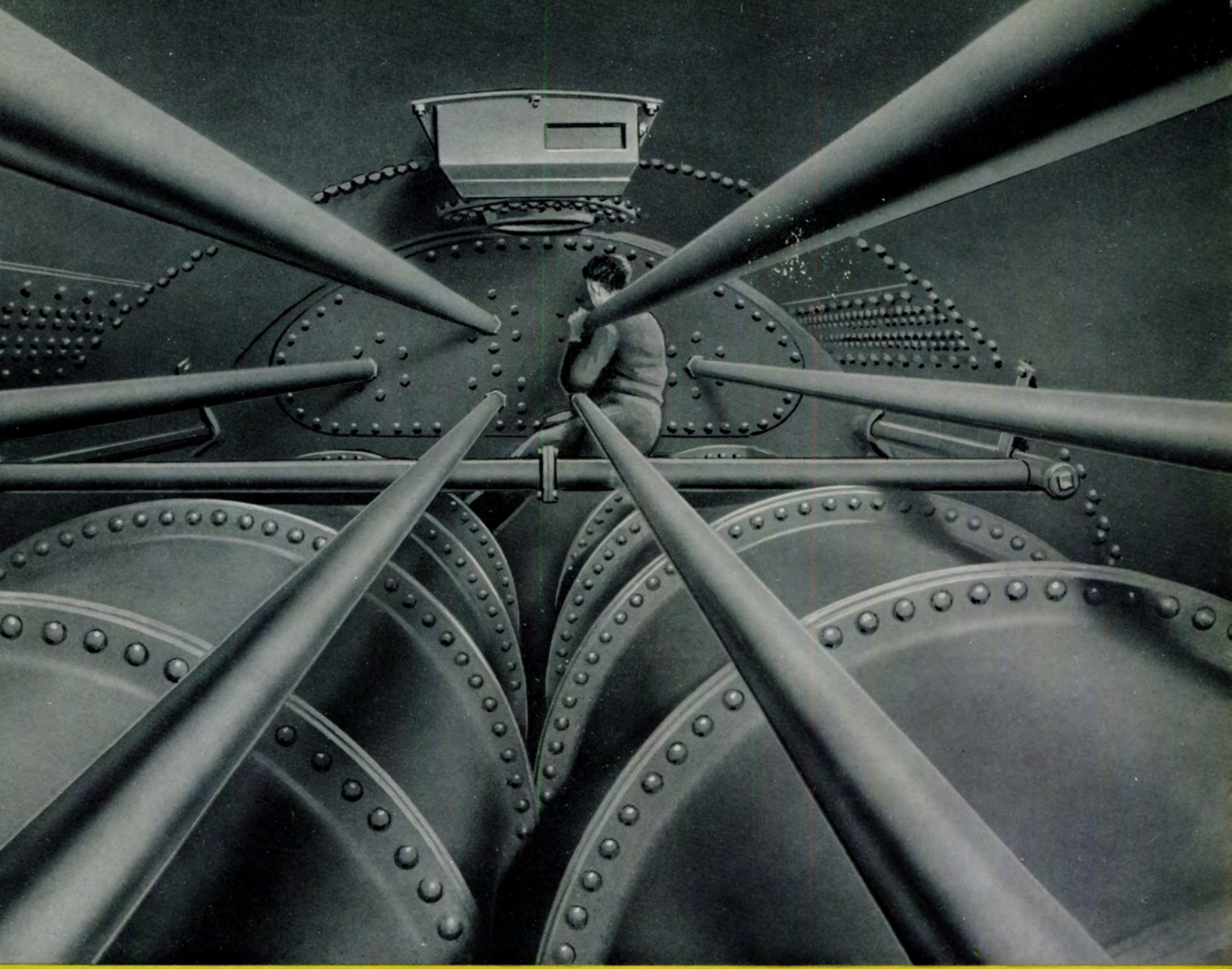


SECTION A-A



SECTIONAL SIDE ELEVATION

Patent Nos. 429,383 and 475,031



THIS PHOTOGRAPH SHOWS ACCESSIBILITY IN THE "SUPER-ECONOMIC" BOILER ABOVE THE FLUES (see notes on previous page).

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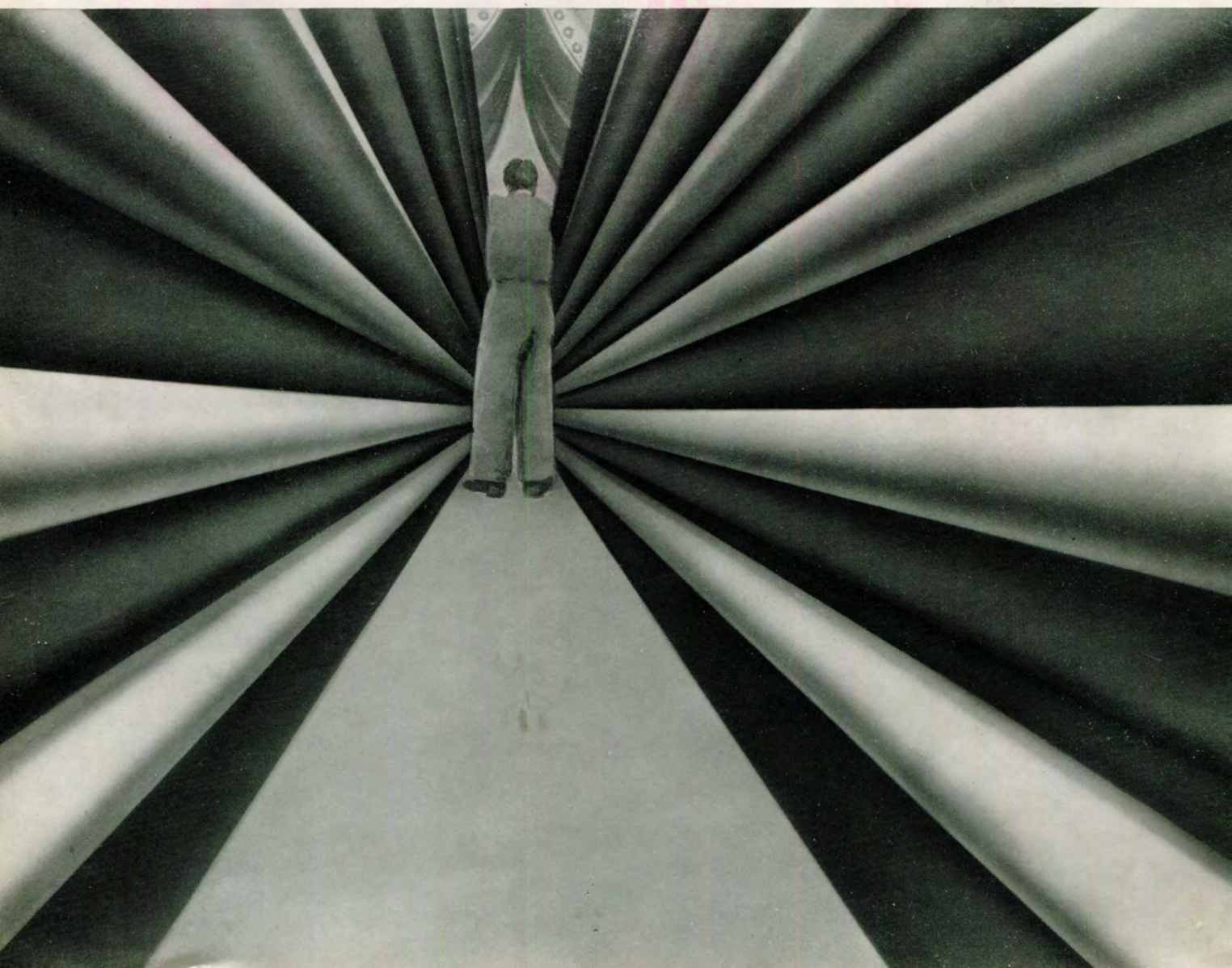
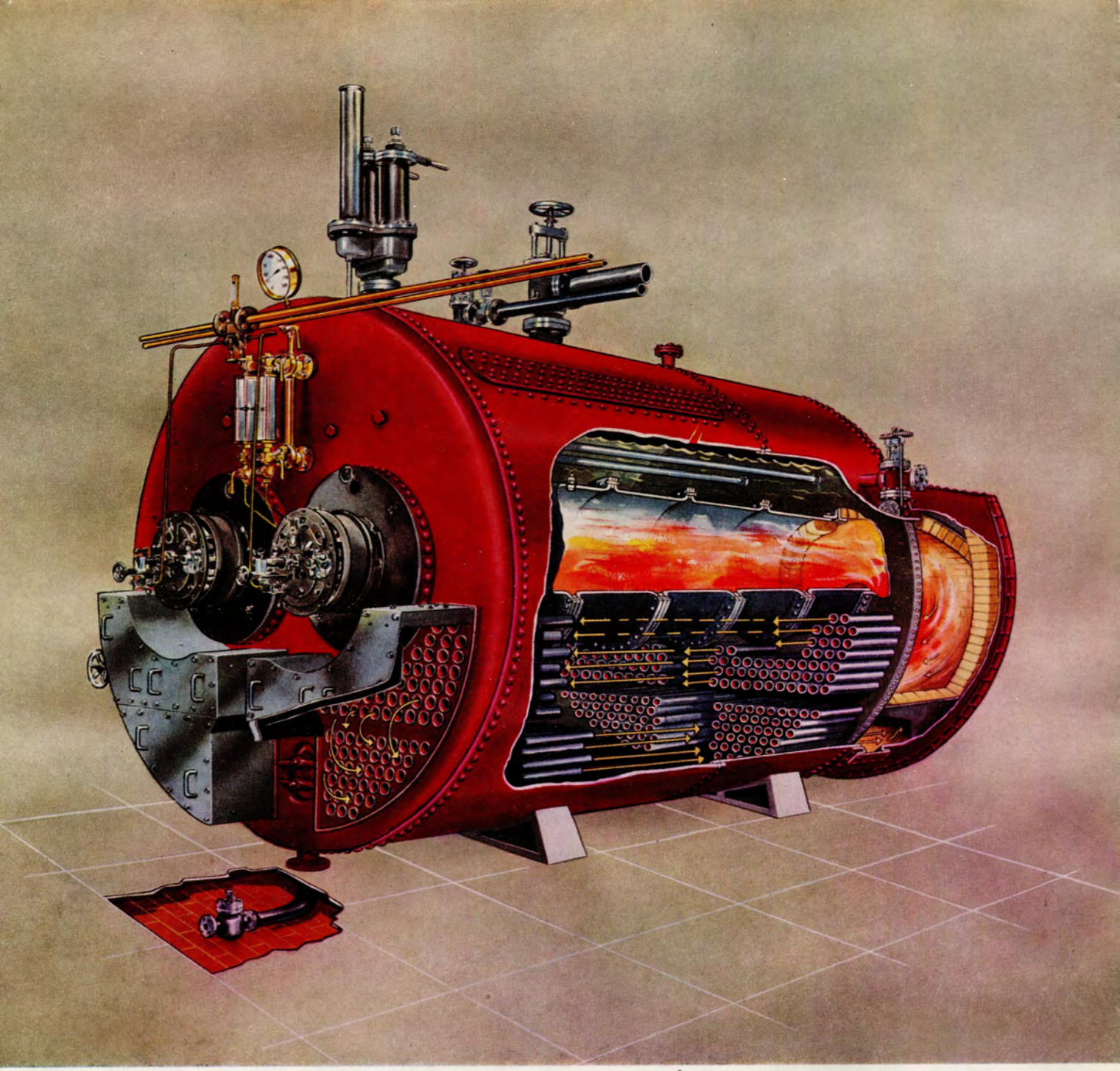
THIS PHOTOGRAPH SHOWS ACCESSIBILITY IN THE "SUPER-ECONOMIC" BOILER BELOW FLUES BETWEEN GROUP OF TUBES (see notes on previous page).





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DANKS-NETHERTON
"SUPER-ECONOMIC" BOILER

(Patent Nos. 429,383 and 475,031)

The Danks-Netherton Patent "Super-Economic" Boiler, illustrated on the opposite page, is the result of over a century's experience in design and construction of Boilers and has many advantages not possessed by any other boiler. It is without doubt the finest proposition in steam or hot water boilers on the market, because :

It gives the highest all-round efficiency.

It burns any kind of fuel, solid, liquid or gaseous, hand or machine-fired.

It employs the contra flow principle of heat exchange.

It occupies very little space.

It is scientifically, rationally, and liberally designed.

It is entirely self-contained and requires no brick settings.

It is cheap to buy, cheap to install, and cheap to operate.

It has the approval of Consulting Engineers and Insurance Companies.

No stagnant cold water at the bottom of the boiler.

The design permits effective use of a fusible plug which the ordinary Economic does not.

Entirely accessible, both above and below the flue, and at the bottom of the shell.

Built by craftsmen who have a lifetime experience in building boilers.

Behind it is the reputation of a firm with experience in boiler-making since 1840.

British design, British materials, British workmanship, and British robustness throughout.

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STANDARD SIZES OF "SUPER-ECONOMIC" BOILERS

ED EVAPORATION PER HOUR			DIAMETER OF BOILER	LENGTH OVER TUBE PLATES	OVERALL LENGTH OF BOILER ONLY	FLUES		CHIMNEY	
From Feed at 60°F.	From and at 212°F.	Million B.Th.U.s				No.	Size	Diameter	Height
1,668	2,000	1.94	5′ 6″	10′ 0″	14′ 0″	1	2′ 6″	1′ 3″	50′ 0″
2,083	2,500	2.43	6′ 0″	10′ 0″	14′ 0″	1	2′ 9″	1′ 6″	50′ 0″
2,500	3,000	2.91	6′ 6″	11′ 0″	15′ 6″	1	3′ 0″	1′ 6″	50′ 0″
3,340	4,000	3.88	7′ 0″	12′ 0″	16′ 6″	1	3′ 3″	1′ 9″	50′ 0″
4,160	5,000	4.85	7′ 6″	13′ 0″	17′ 6″	1	3′ 6″	2′ 0″	50′ 0″
5,000	6,000	5.82	7′ 9″	14′ 0″	19′ 0″	1	3′ 9″	2′ 3″	50′ 0″
5,840	7,000	6.78	8′ 0″	14′ 0″	19′ 0″	1	4′ 0″	2′ 3″	50′ 0″
7,080	8,500	8.25	8′ 6″	14′ 0″	19′ 0″	1	4′ 3″	2′ 6″	50′ 0″
8,340	10,000	9.7	9′ 0″	16′ 0″	22′ 0″	2	3′ 0″	2′ 6″	50′ 0″
9,580	11,500	11.18	9′ 6″	16′ 0″	22′ 0″	2	3′ 3″	2′ 9″	50′ 0″
10,830	13,000	12.6	10′ 0″	16′ 0″	22′ 0″	2	3′ 6″	3′ 0″	50′ 0″
12,080	14,500	14.1	10′ 6″	16′ 0″	22′ 0″	2	3′ 9″	3′ 3″	50′ 0″
13,330	16,000	15.52	11′ 0″	16′ 0″	22′ 0″	2	4′ 0″	3′ 3″	50′ 0″
14,580	17,500	16.98	11′ 6″	16′ 0″	22′ 0″	2	4′ 3″	3′ 6″	50′ 0″
15,820	19,000	18.42	12′ 0″	16′ 0″	22′ 0″	2	4′ 6″	3′ 6″	50′ 0″

The above evaporations are based on coal firing with fuel having a calorific value of not less than 11,000 B.Th.U.s/lb. and fitted with mechanical stokers. For oil-firing, evaporations on application.

When fired with other fuels and coal of a lower calorific value the evaporations may be modified.

Typical EFFICIENCY TESTS

Size of boiler	10′ 0″ diameter. 15′ 0″ long.	9′ 6″ diameter. 17′ 0″ long.	8′ 9″ diameter. 16′ 0″ long.
Firing Equipment or Method of Firing.	Coking type. Mechanical Stoker.	Coking type. Mechanical Stoker.	
Fuel	1″ Slack. Calorific value (gross) 11,909 B.Th.U.s /lb.	Singles. Calorific value (gross) 12,257 B.Th.U.s /lb.	Oil Fired. Calorific value (gross) 18,470 B.Th.U.s /lb.
Average steam pressure	35 lbs.	225 lbs.	92 lbs.
Temperature of steam at average steam pressure	281°F.	397°F.	332°F.
Average feed temperature	135°F.	65°F.	183°F.
Average gas outlet temperature	390°F.	445°F.	455°F.
Average CO_2 at outlet	12.1%	13.2%	10.7%
Average water evap. lbs. /hr.	10,920 lbs.	9,500 lbs.	7,850 lbs.
Water evap. /lb. fuel	9.276 lbs.	8.43 lbs.	14.25 lbs.
Equivalent evap. F. & A. 212°F.	10.22 lbs.	10.2 lbs.	15.25 lbs.
Boiler Efficiency on gross calorific value	83.4%	81.5%	79.2%

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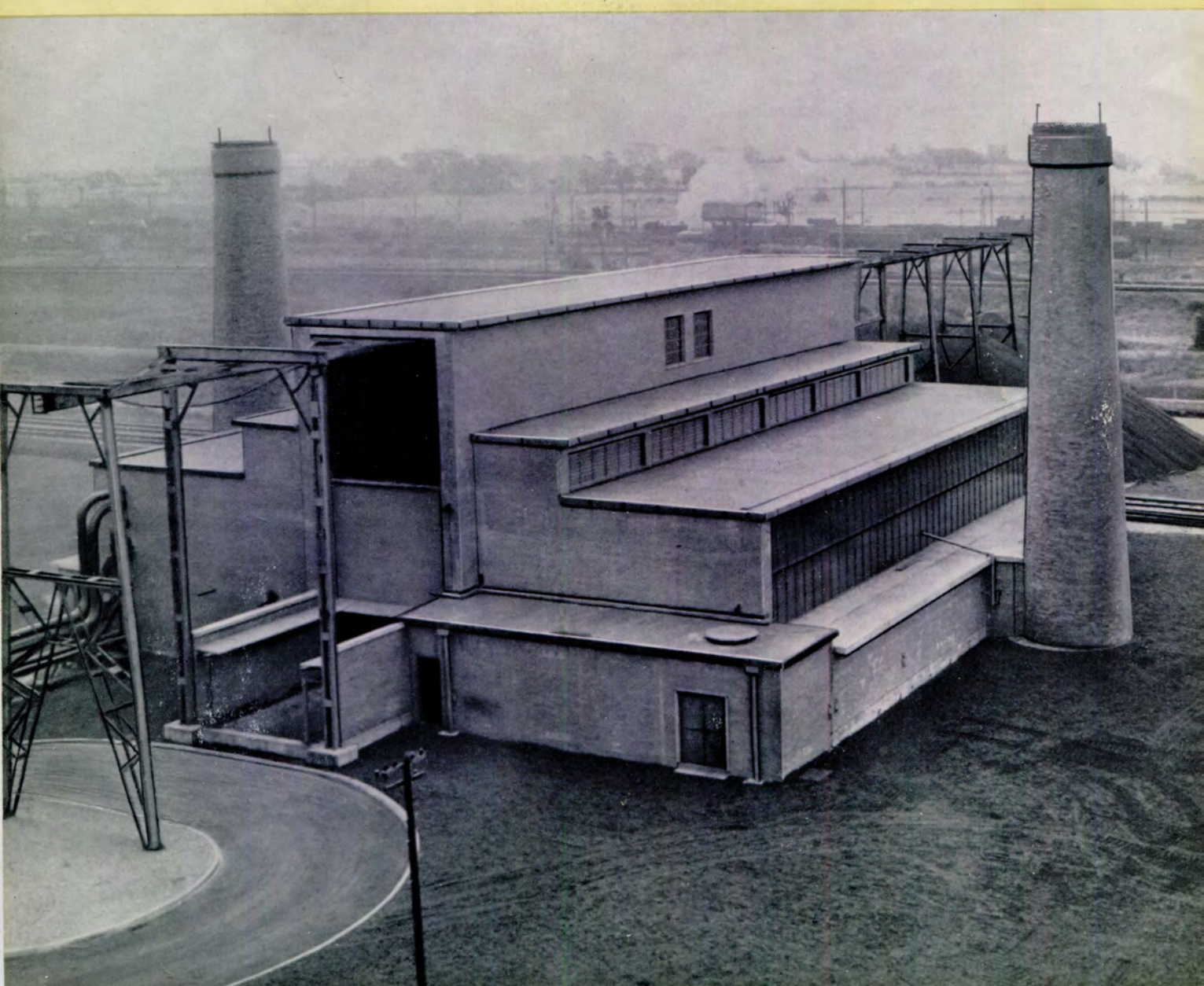
COMPLETE BOILER INSTALLATION COMPRISING BOILER HOUSE, CHIMNEYS, 10 "SUPER-ECONOMIC" BOILERS (SHOWN OPPOSITE), AND ALL ANCILLARY EQUIPMENT AT :—

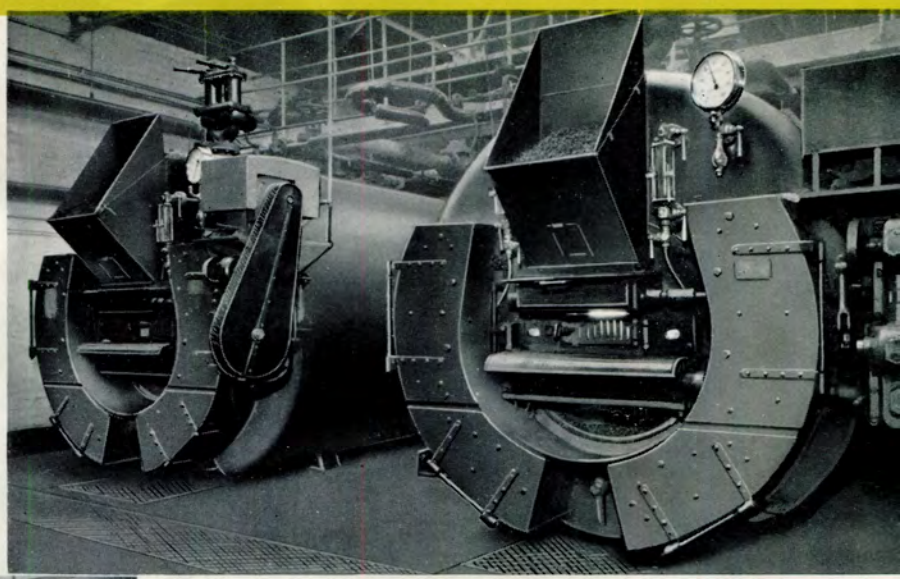
STEEL CO. OF WALES LTD.,
TROSTRE WORKS,
LLANELLY,
S. WALES.

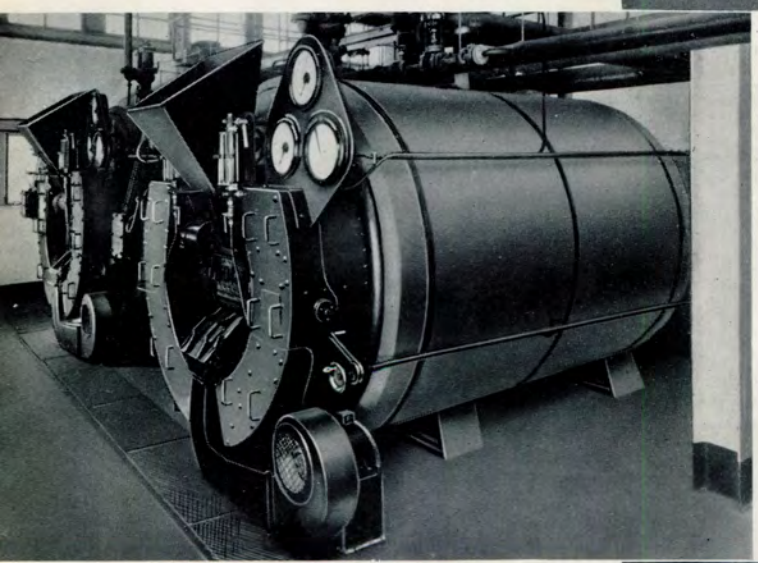


installed in Hospitals . . . .

TWO "SUPER-ECONOMIC" BOILERS,
STOKER FIRED, 8ft. 0in. dia., AT :—
ROYAL MANCHESTER CHILDREN'S
HOSPITAL, PENDLEBURY.

Consulting Engineers :
A. B. MALLINSON & CO.,
SALFORD.





TWO "SUPER-ECONOMIC" BOILERS,
7ft. 0in. dia., AT :—
MID-ULSTER HOSPITAL,
MACHERAFET, CO. LONDONDERRY.
(Northern Ireland Hospital Authority.)

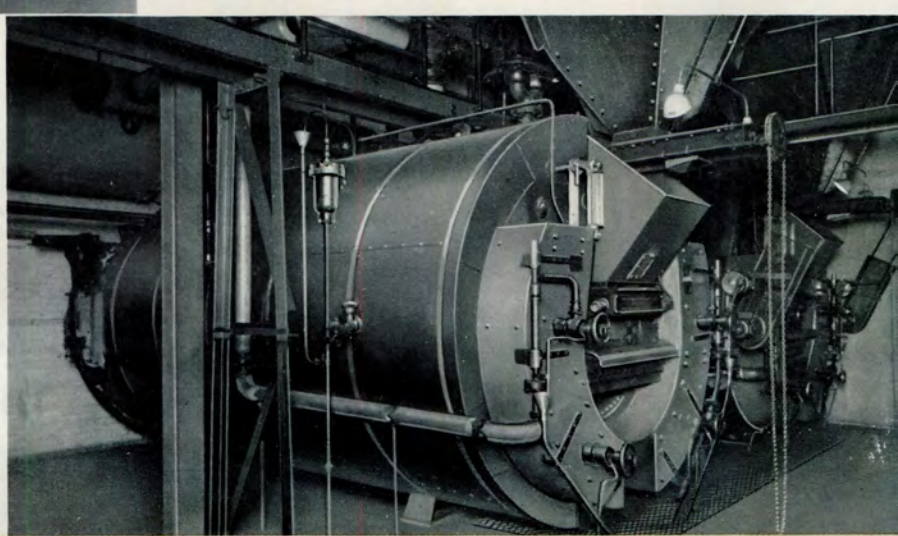
Consulting Engineers :
F. W. PARKINSON & PARTNERS, BELFAST.

Heating Engineers :
D. M. HOLMES, LONDONDERRY.

TWO "SUPER-ECONOMIC" BOILERS,
STOKER FIRED, 9ft. 0in. dia., AT :—
THREE COUNTY HOSPITAL,
ARLESLEY.

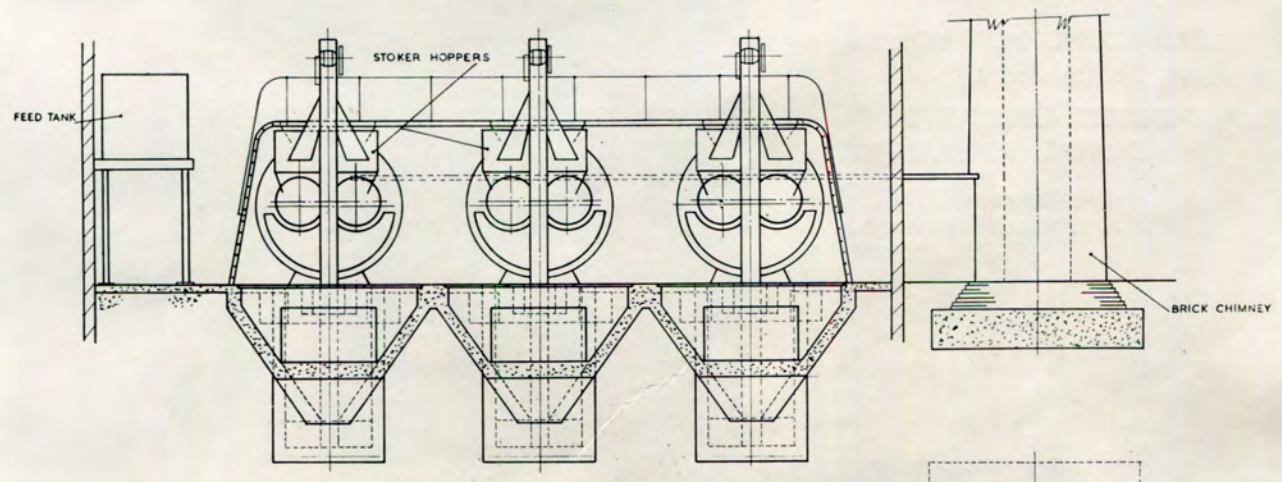
Consulting Engineers :
J. ROGER PRESTON & PARTNERS,
LONDON.

Heating Engineers :
FRETWELL HEATING CO.,
LONDON.

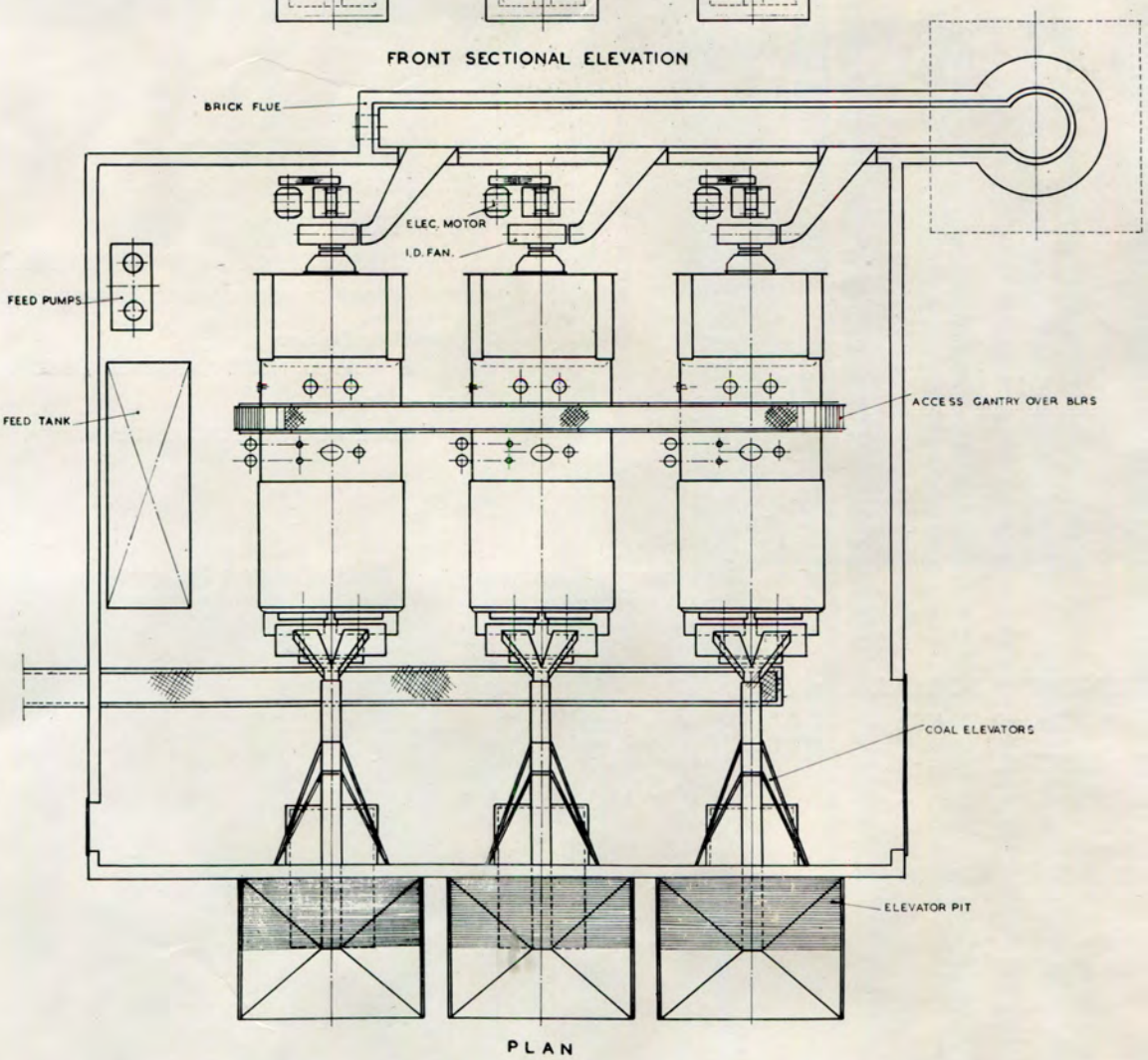


DANKS of NETHERTON Ltd., NETHERTON · DUDLEY WORCS.

TYPICAL ARRANGEMENT OF THREE "SUPER-ECONOMIC" BOILERS

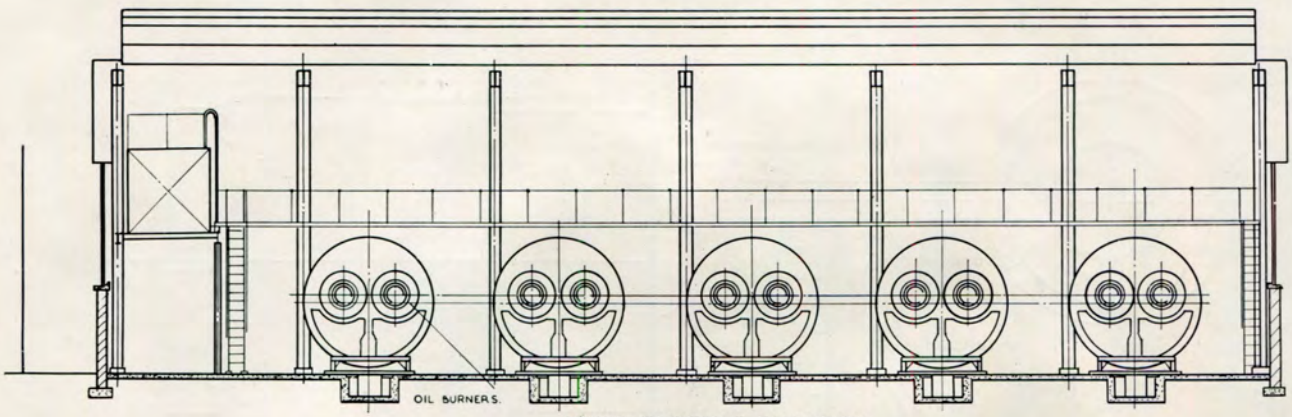


FRONT SECTIONAL ELEVATION

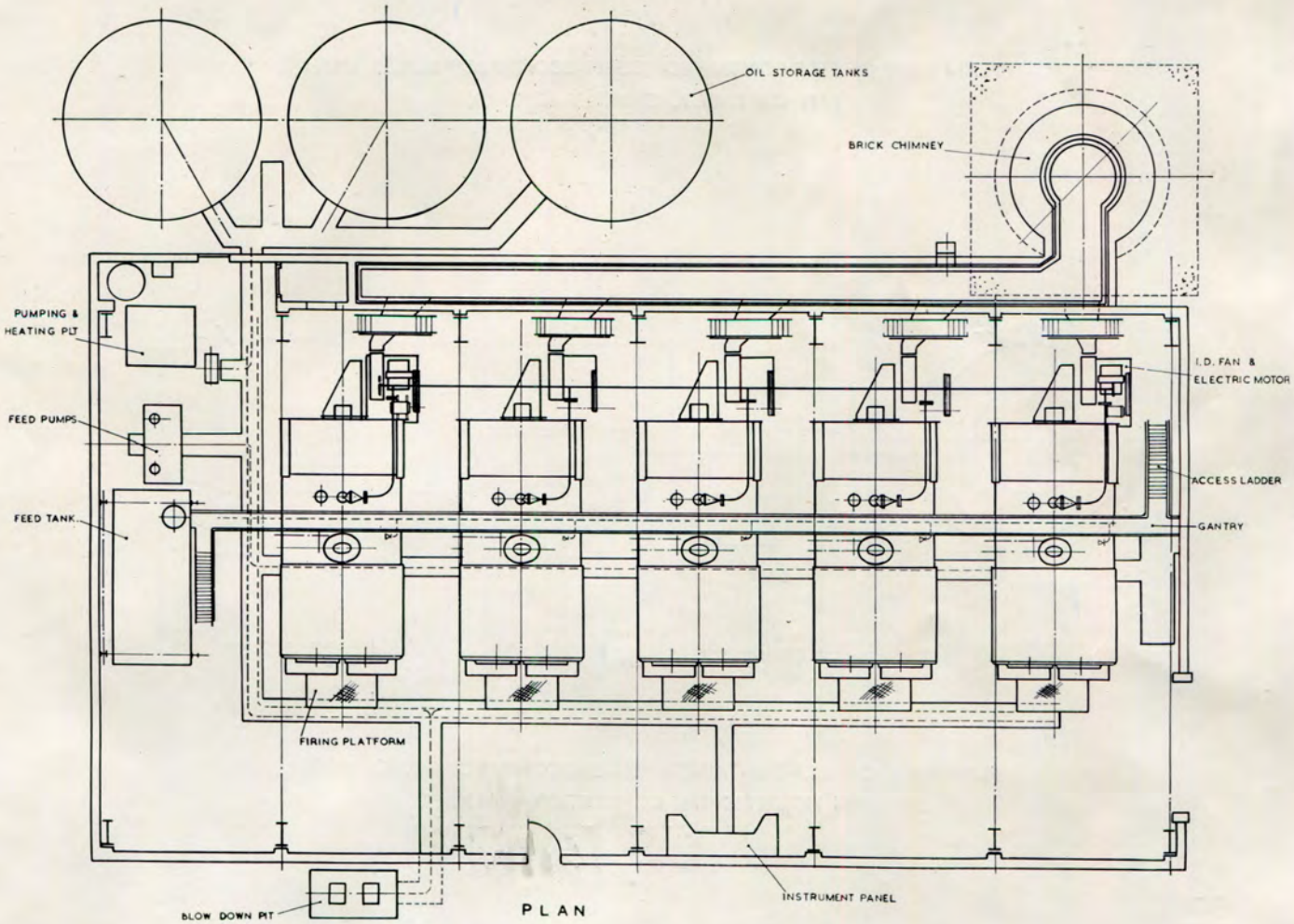


PLAN

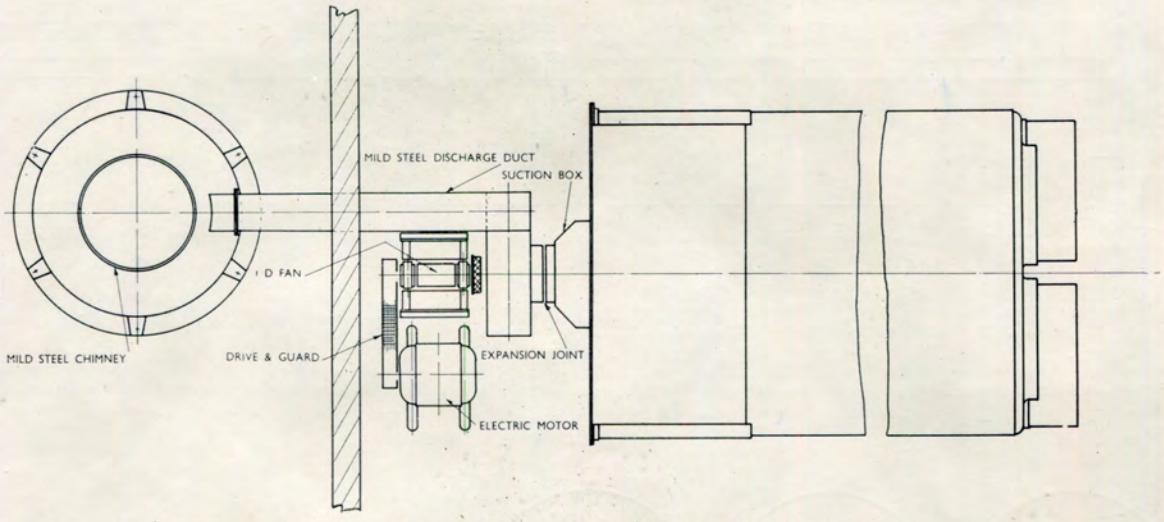
TYPICAL ARRANGEMENT OF FIVE "SUPER-ECONOMIC" BOILERS



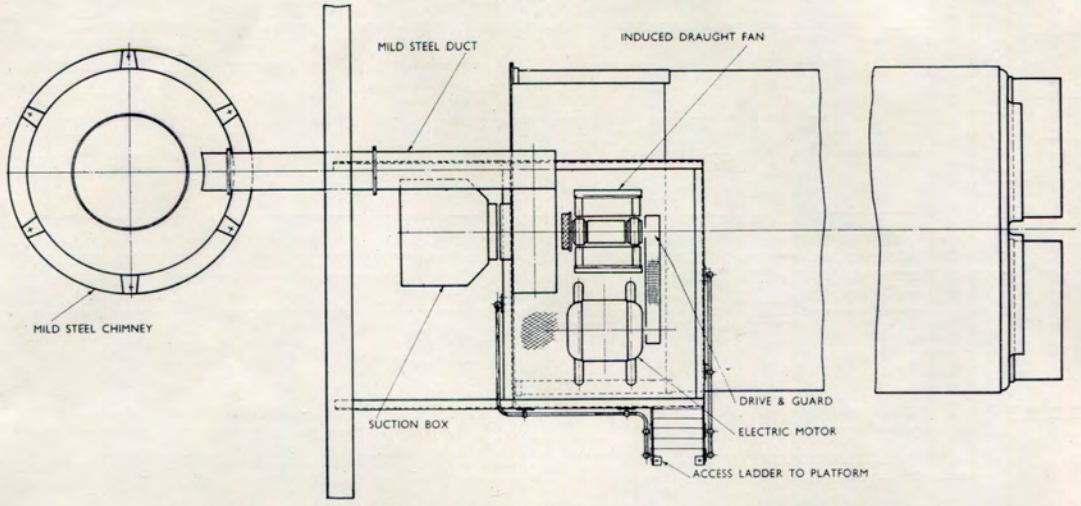
FRONT SECTIONAL ELEVATION



PLAN

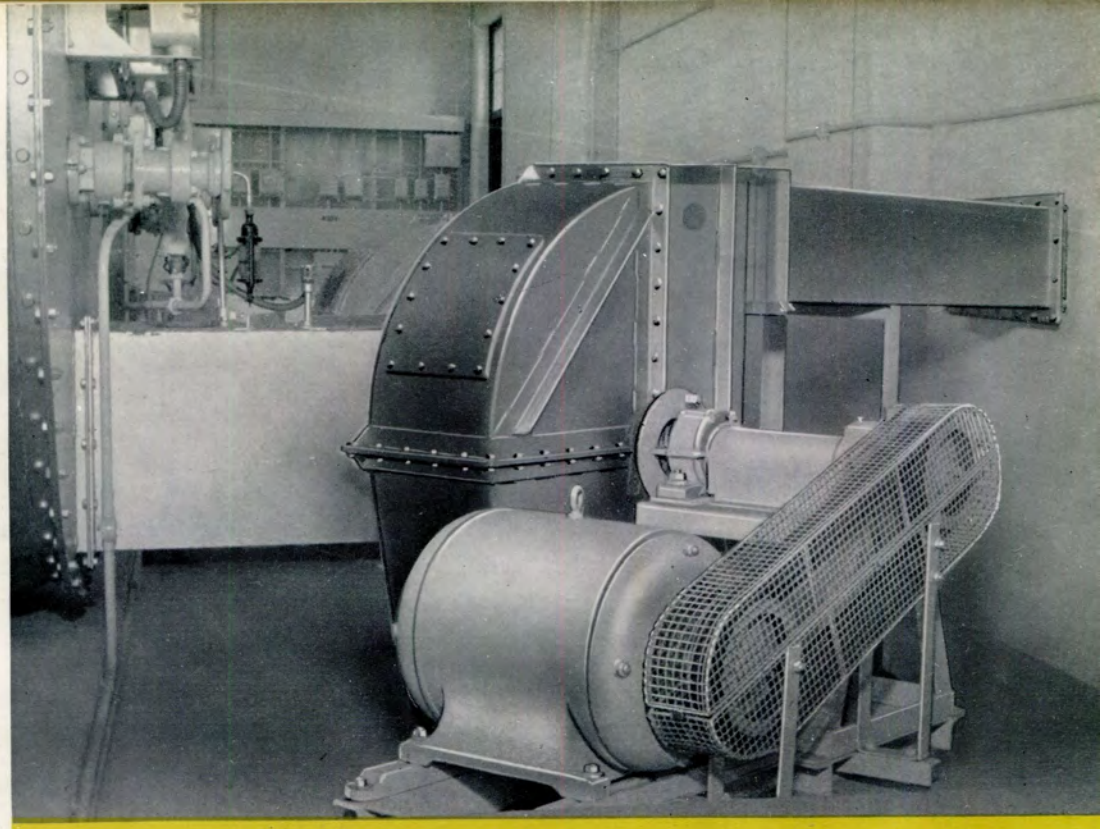


PLAN VIEW OF SELF-CONTAINED "SUPER-ECONOMIC" BOILER WITH FAN ON FLOOR, CHIMNEY AT BACK

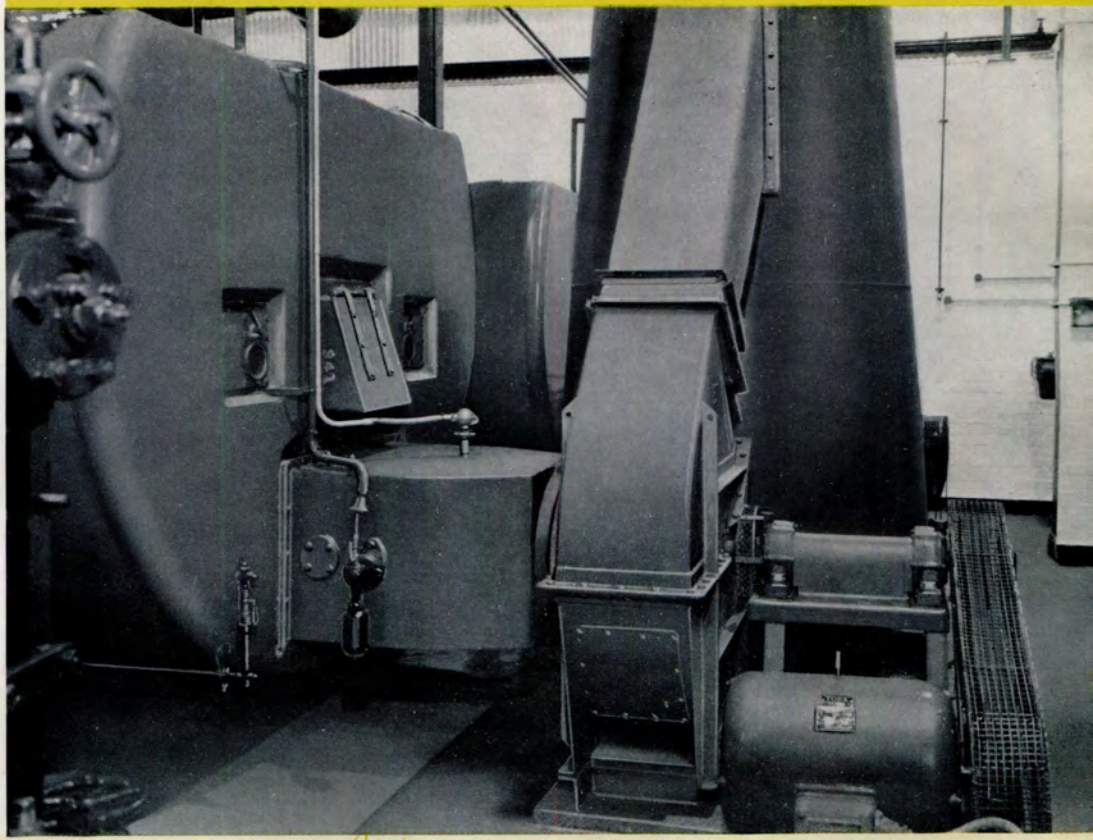


PLAN VIEW OF SELF-CONTAINED "SUPER-ECONOMIC" BOILER WITH FAN MOUNTED ON COMBUSTION CHAMBER

DANKS OF NETHERTON LIMITED ESTABLISHED 1840



ARRANGEMENT OF I.D. FAN AND MOTOR CONNECTING TO BRICK FLUE.



ARRANGEMENT OF I.D. FAN AND MOTOR CONNECTING TO STEEL CHIMNEY.

General Specification of a "SUPER-ECONOMIC" BOILER

GENERAL CONSTRUCTION : All boilers are constructed in accordance with the appropriate British Standard Specification, with recognised and approved departures therefrom to embrace modern construction, design and methods ; also, boilers for shipment abroad to the requirements of the governing bodies in those countries.

This brief specification covers for riveted construction. We reserve the right to fusion weld whole, or in part, as suits our production requirements. This welding will be carried out in accordance with Class I standards, where necessary.

MATERIALS : Boiler plates to be of Siemens-Martin Open Hearth Steel Boiler quality. Those forming the shell having an ultimate tensile strength of 28/32 tons, with an elongation of 20% in 8", and those for flues and end plates, 24/28 tons tensile strength, with an elongation of 23% in 8". All material will comply with appropriate British Standard Specification, where these apply.

SHELL : Constructed in a suitable number of rings, each in one plate circumferentially. All circumferential seams lapped and riveted ; longitudinal seams having double butt straps.

FLUES : Constructed in sections, each section made from one plate. Longitudinal seams welded, flanged at each end by machine at one heat, flanges turned on edge and caulking rings fitted between flanges, and riveted together, forming what is known as "anti-collapsive joint."

END PLATES : Each made from one solid plate, flanged by special machinery to fit the shell internally, and turned perfectly true on their edges. Both ends bunged out to receive flues. Holes for tubes to be carefully bored in the end plates.

STAYS : The area above flues and tubes to be supported by a suitable number of longitudinal steel stay bars, complete with nuts, and provided with doubling plates or washer plates.

TUBES : Boiler fitted with the necessary gas tubes to give the required heating surface, and arranged in two groups to give two passes for the path of the gases. Plain tubes to be expanded and welded into tube plates at the gas inlet of the tubes. All stay tubes to be expanded and welded into front and back tube plates. Tubes are fitted to give wide tube

plate ligaments, providing improved water circulation and thereby an increased cooling effect to the tube plates. All tubes to be in accordance with the appropriate British Standard Specification.

MANHOLES : Each boiler is provided with two manholes : one on top of the shell of the boiler, and the other in the bottom of the front end plate, to provide access to the interior of the boiler, including underneath the flue.

FUSIBLE PLUG : Each boiler is provided with an approved type fusible plug, placed in the top of the furnace above the grate, and at the upper level of all heating surfaces, so that in the event of failure in water supply, the fusible plug is the first part of the heating surface to be uncovered by water.

STANDPIPES : Each boiler provided with the necessary fusion welded, or solid forged standpipes, welded or riveted to the shell, for the steam and water mountings. Connections provided for high and low water level alarm, and, if required, for feed-water controls.

RIVETING : The whole of the riveting, including shell, flue, and ends, wherever practicable, to be done by special hydraulic machinery.

SMOKE BOXES : Two smoke boxes are provided on the front of each boiler. Smoke boxes made of mild steel and secured to the front end plate. The smoke boxes are lined on the inside, on the top and side, and doors are provided with baffleplate, with insulation inter-lining. Doors to be of the lift off type.

COMBUSTION CHAMBER : Combustion chamber formed by mild steel extension fitted to boiler shell. Chamber to be lined with high-grade refractory material. Ends of flues in combustion chamber will be fitted with firebrick flue and protection ring. Outlet chamber to be fitted with internal extension complete with damper and operating gear for operation from the boiler front. Chamber to be complete with large cleaning out doors, and sight holes fitted in side or back.

STEAM AND WATER MOUNTINGS : Standard Steam and Water mountings comprise : Spring loaded safety valve ; Main steam stop valve ; Check feed valve ; Parallel slide blow-off valve ; Automatic water gauges and protectors ; Pressure gauge and syphon ; Drain pipes to water gauges ; Inspector's test cock.

FAN : One Induced draught fan constructed of heavy mild steel plate and stiffening angles, rotor of the Multivane type, mounted on a large diameter shaft, with roller bearings, bolted to substantial pedestal, connected to the side of the front casing.

Fan driven by either A.C. or D.C. motor, steam engine, or steam turbine. In the case of a motor driven fan, the drive between an and motor is by "Vee" rope, and suitable pulleys keyed to the fan and motor shafts, complete with guard.

Fan and prime mover bolted to substantial mild steel plinth for fixing on boiler-house floor, or to a substantial structure for mounting above boiler, over boiler combustion chamber.

ACCESSORIES : Cast Iron Cradles for seating boiler, provided with face bearing strips.
Tube Brush and Rod.
One set of Spanners and Rack.
Foot Plate and Frame.

CHIMNEY : When called for, we can supply chimneys suitable for our "Super-Economic" boilers. These can be built of steel or in brick. In the latter case, the work is carried out by our own Civil Engineering Department.

The standard height of these chimneys is 50′ 0″, and in the case of steel chimneys, these can be of either the guyed or self-supporting type, and both are fitted with painting gear and ropes. All chimneys have suitable access and cleaning doors, and where necessary roof plates, cravats, and other types of weather seals can be supplied.

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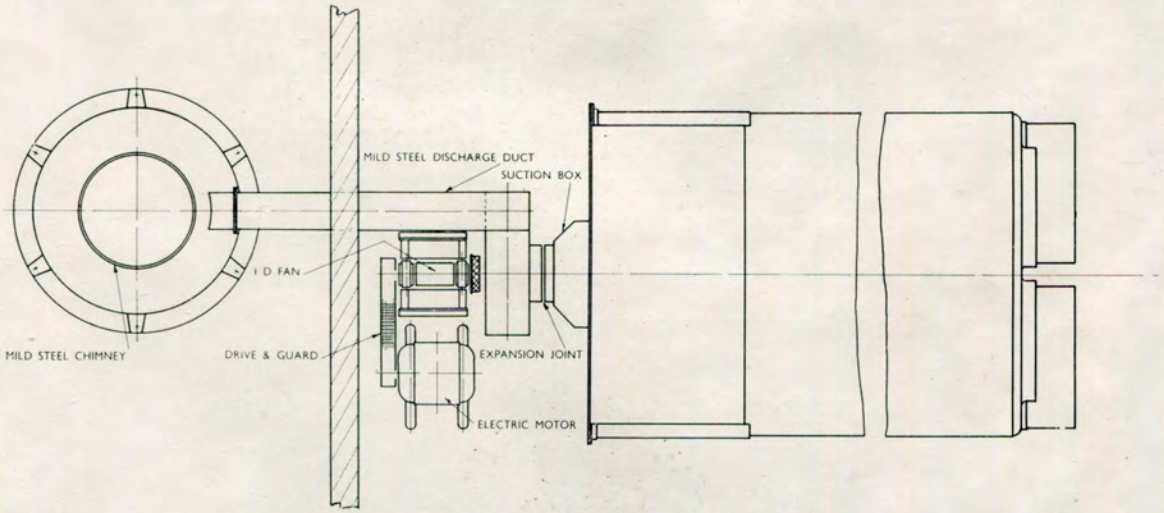
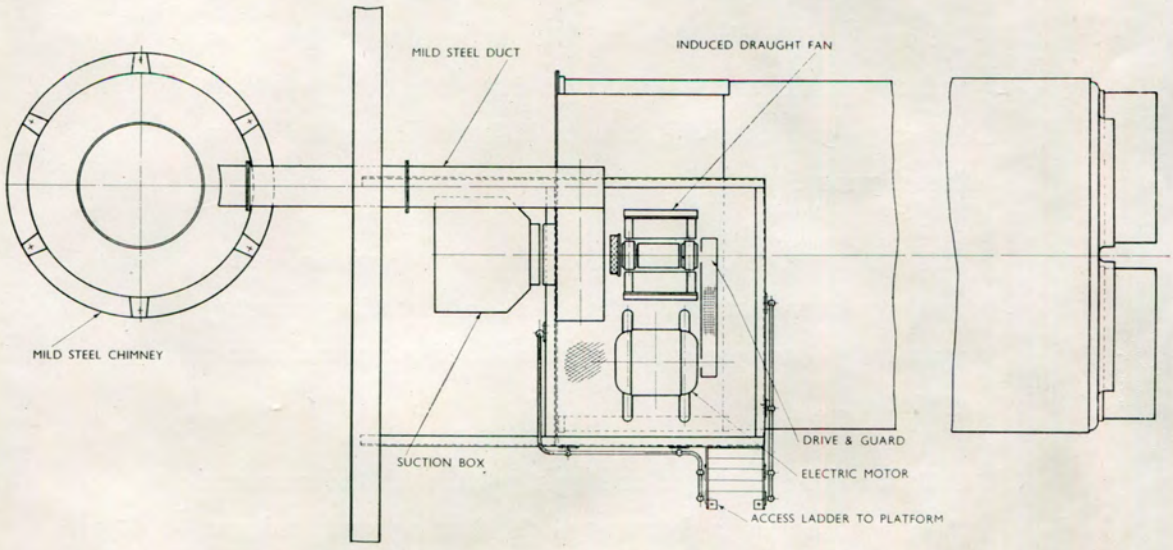


PLAN VIEW OF SELF-CONTAINED SUPER-ECONOMIC BOILER WITH FAN ON FLOOR, CHIMNEY AT BACK



PLAN VIEW OF SELF-CONTAINED SUPER-ECONOMIC BOILER WITH FAN MOUNTED ON COMBUSTION CHAMBER

DANKS OF NETHERTON LIMITED
ESTABLISHED 1840

SELF-CONTAINED ECONOMIC BOILER

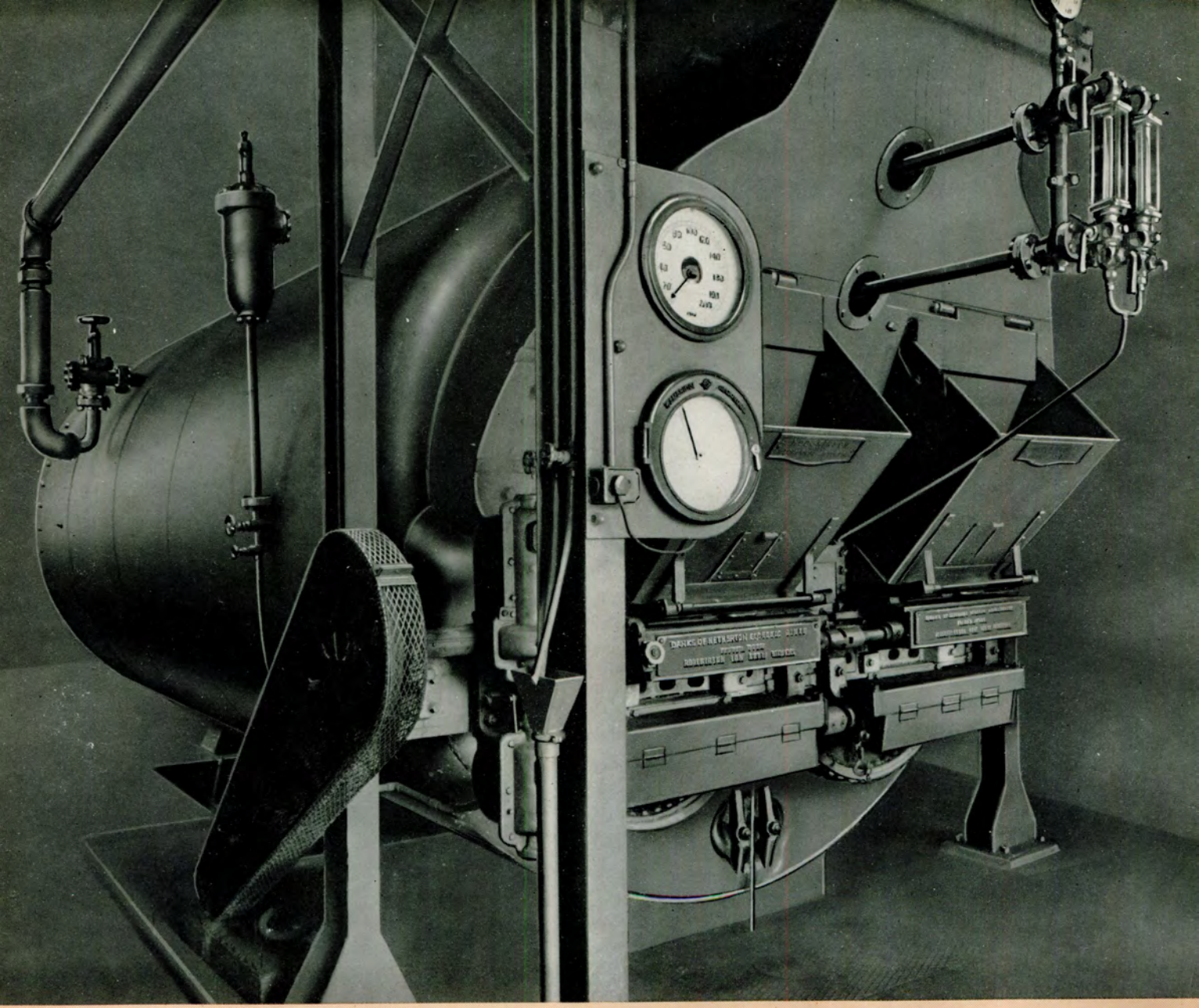
The Self-contained Economic Boiler, of the two pass type, is very popular because it occupies less space and is cheaper to instal than the Lancashire Boiler. The Economic takes approximately half the space required for the Lancashire, for equal evaporation.

The Economic Boiler, being of the self-contained type, requires no external brickwork ; therefore it gives a greater efficiency as there is no loss due to the infiltration of air into the flues and brickwork setting.

The heating surface is composed of furnace flues and tubes, distributed throughout the water space. The gases pass from the grate over the bridge, along the flues into the combustion chamber at the rear, return to the front end through the small return tubes, into the smokebox direct to the chimney, or via Induced Draught Fan to the chimney.

This boiler has a brick lined combustion chamber, which becomes incandescent when the boiler is working ensuring practically complete combustion and reducing smoke to a minimum.

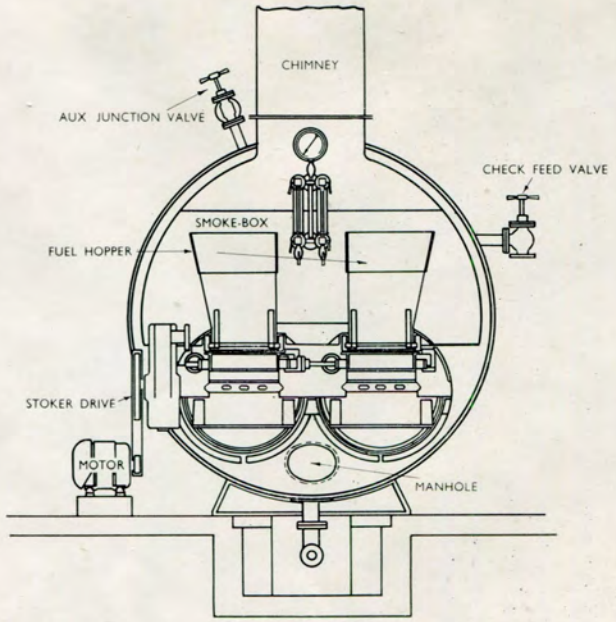
Boilers can be arranged as single units, with independent chimneys, or as a battery with ducting and Induced Draught Fans and one chimney.



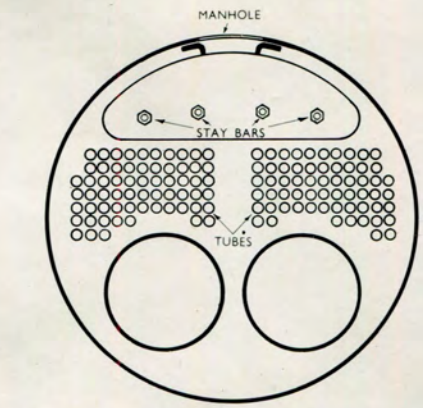
SELF-CONTAINED DOUBLE PASS ECONOMIC BOILER.
10′ 0″ DIAMETER, 16′ 0″ O.T.P. FOR 200 LBS. W.P.

DANKS OF NETHERTON LIMITED
ESTABLISHED 1840

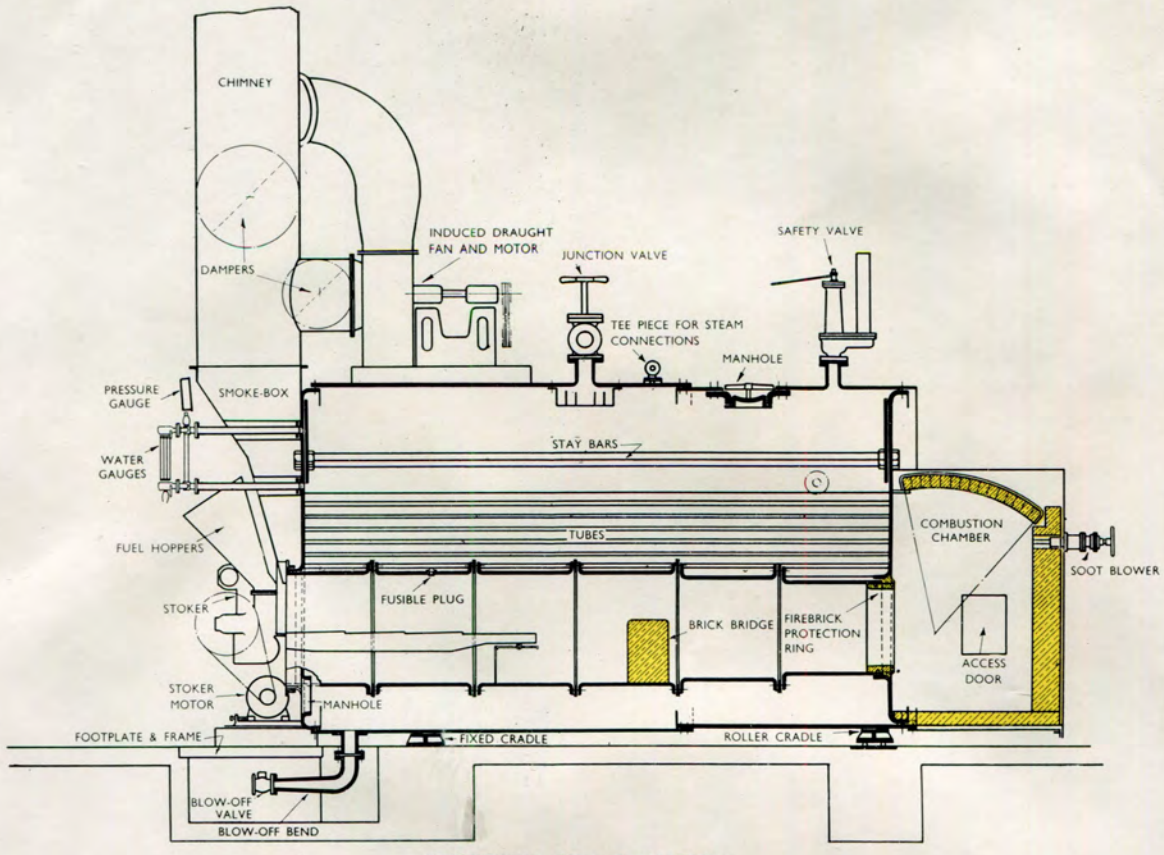
SECTIONAL DRAWING OF SELF-CONTAINED DOUBLE PASS ECONOMIC BOILER



FRONT ELEVATION



SECTION THROUGH BOILER



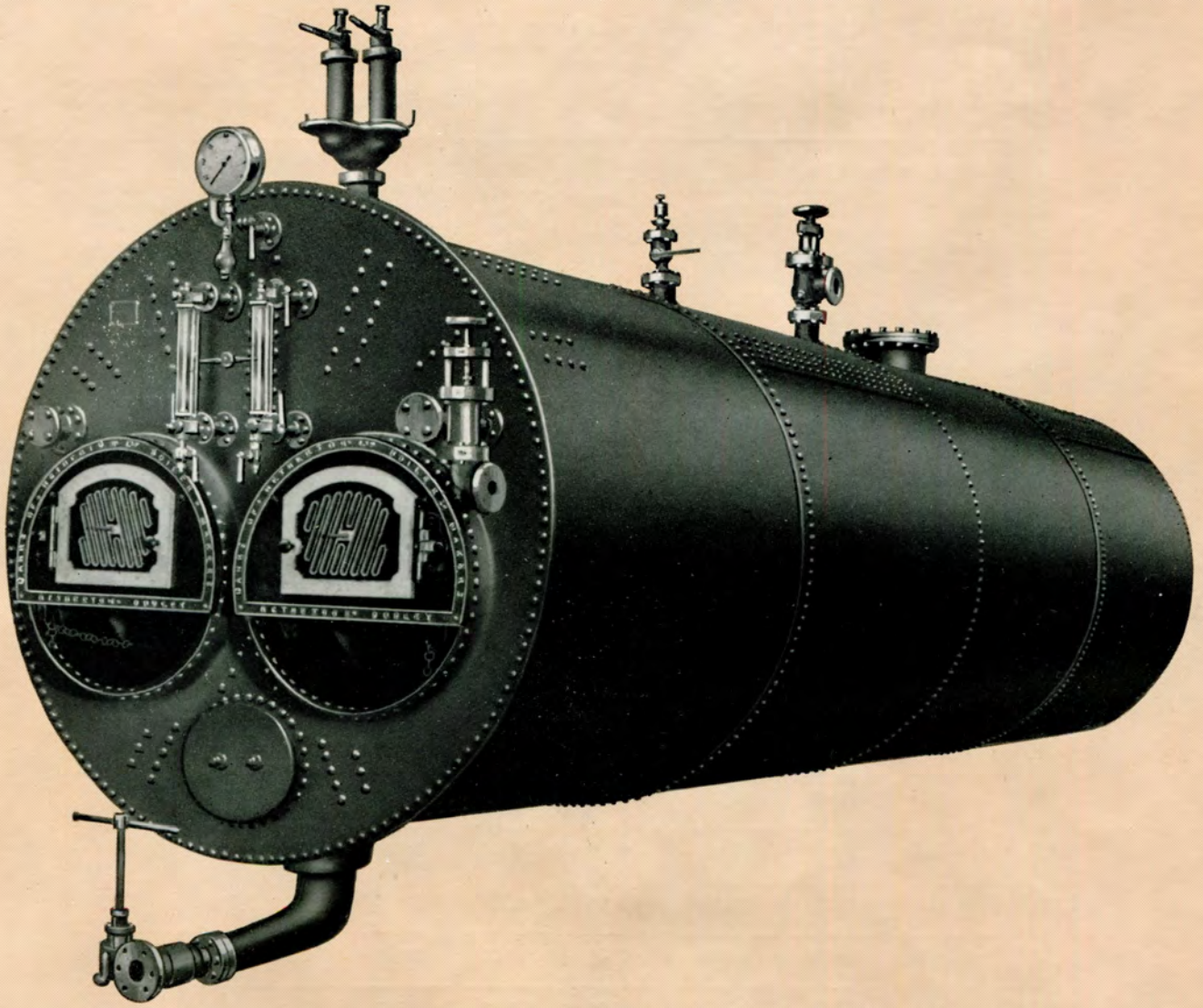
SECTIONAL SIDE ELEVATION

DANKS of NETHERTON Ltd., NETHERTON · DUDLEY WORCS.

SELF-CONTAINED
DOUBLE PASS ECONOMIC BOILERS

Rated Evaporation in lbs./hr.				Diameter of Boiler	Length over Tube Plates	Overall length of Boiler only	Flues		Total Heating Surface in sq. ft.
Hand Fired		Stoker Fired							
From Feed at 60°F.	From and at 212°F.	60°F.	212°F				No.	Size	
1,668	2,000	1,668	2,000	5′ 6″	10′ 0″	13′ 0″	1	2′ 9″	335
2,083	2,500	2,083	2,500	6′ 0″	10′ 0″	13′ 0″	1	3′ 0″	420
2,500	3,000	2,500	3,000	6′ 6″	12′ 0″	15′ 6″	1	3′ 3″	500
3,340	4,000	3,340	4,000	7′ 0″	12′ 0″	15′ 6″	1	3′ 6″	670
4,160	5,000	4,160	5,000	7′ 0″	14′ 0″	15′ 6″	1	3′ 6″	835
4,580	5,500	5,000	6,000	7′ 6″	14′ 0″	18′ 0″	1	3′ 9″	1,000
5,000	6,000	5,840	7,000	8′ 0″	14′ 0″	18′ 0″	1	4′ 0″	1,170
5,000	6,000	5,840	7,000	8′ 0″	14′ 0″	18′ 0″	2	2′ 6″	1,170
5,840	7,000	7,080	8,500	8′ 6″	16′ 0″	18′ 6″	2	2′ 9″	1,420
6,660	8,000	8,340	10,000	9′ 0″	16′ 0″	20′ 6″	2	3′ 0″	1,670
7,420	8,900	9,580	11,500	9′ 6″	16′ 0″	21′ 0″	2	3′ 3″	1,920
7,840	9,400	10,830	13,000	10′ 0″	16′ 0″	21′ 0″	2	3′ 6″	2,170
8,350	10,000	12,080	14,500	10′ 6″	16′ 0″	21′ 6″	2	3′ 9″	2,420
9,350	11,200	13,330	16,000	11′ 0″	16′ 0″	22′ 0″	2	4′ 0″	2,670
10,000	12,000	14,580	17,500	11′ 6″	16′ 0″	22′ 0″	2	4′ 3″	2,920
		15,820	19,000	12′ 0″	16′ 0″	22′ 0″	2	4′ 6″	3,170
		17,500	21,000	12′ 6″	17′ 0″	23′ 6″	3	3′ 6″	3,500
		19,200	23,000	13′ 0″	17′ 0″	23′ 6″	3	3′ 9″	3,835
		20,800	25,000	13′ 6″	17′ 0″	24′ 0″	3	4′ 0″	4,170

Evaporations are based on coal fuel of free burning bituminous nature of not less than 12,000 B.Th.U.s/lb. It is recommended that all boilers 9′ 0″ dia. and upwards be fitted with mechanical stokers and induced draught fan.



LANCASHIRE BOILER (FLAT ENDED)

Lancashire Boilers are manufactured with either flat or dished ends, and in sizes from 6′ 6″ diam. to 10′ 0″ diam. for working pressures to suit customers' requirements. Complete corrugated flues or corrugated sections can be fitted if required.

We build brickwork settings and chimneys for these boilers as described in the Building section.

See list for standard sizes and evaporations.

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ESTABLISHED 1840

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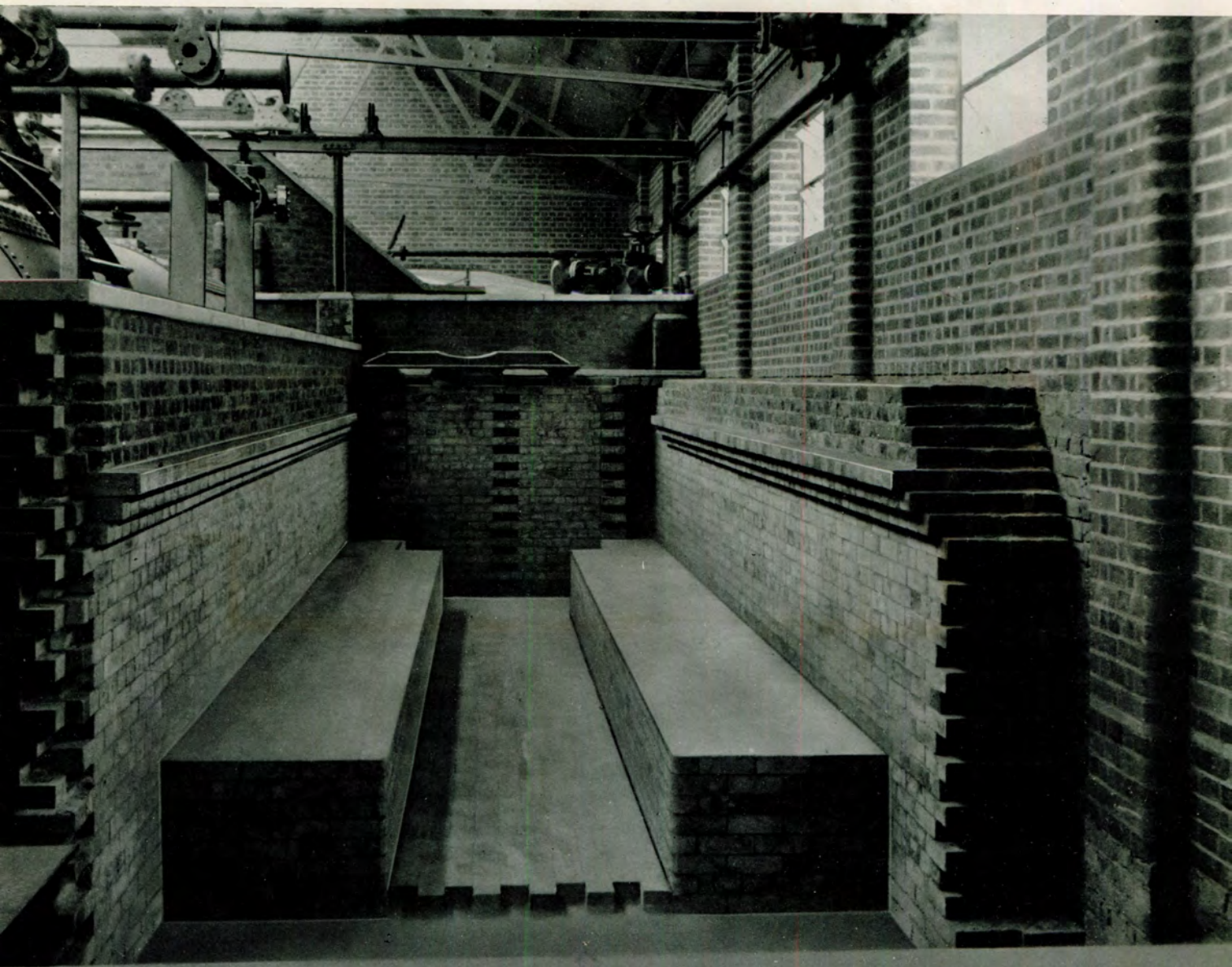
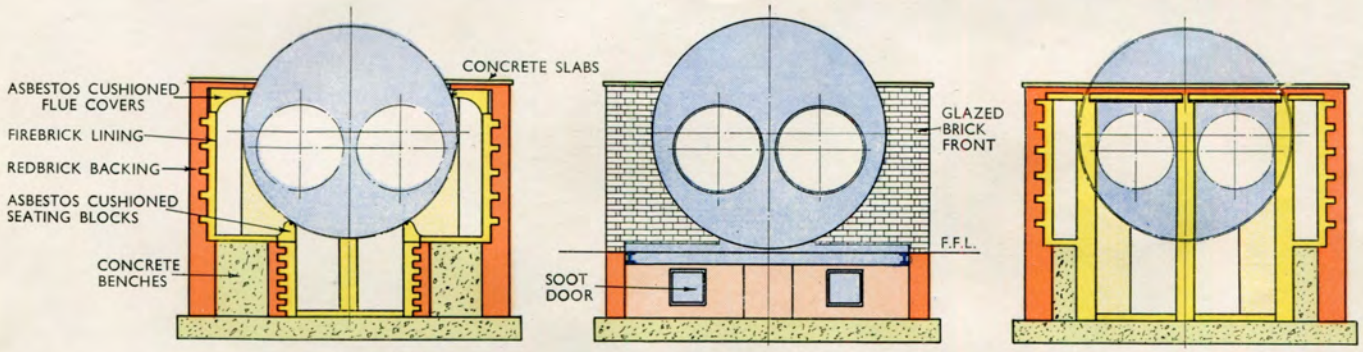
ESTABLISHED 1840

BRICKWORK SETTING UNDER CONSTRUCTION
FOR A LANCASHIRE BOILER



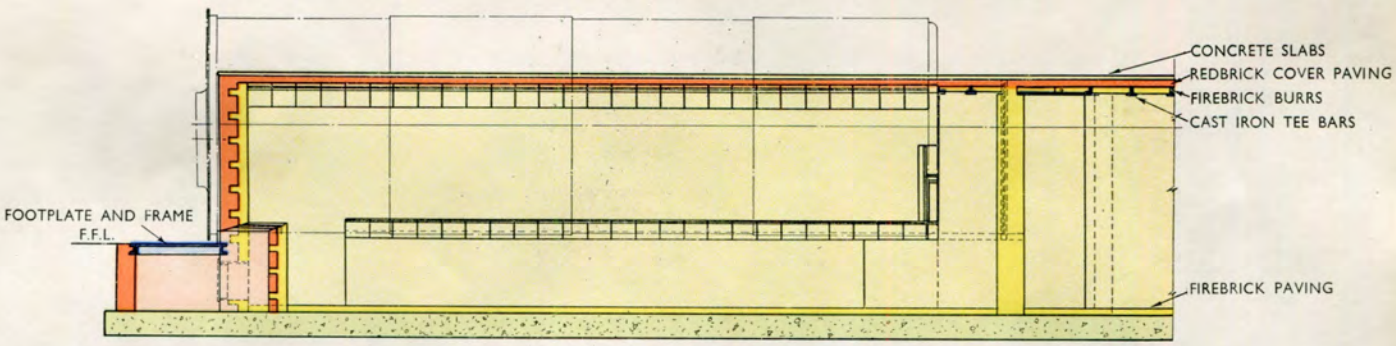
SETTING FOR LANCASHIRE BOILER



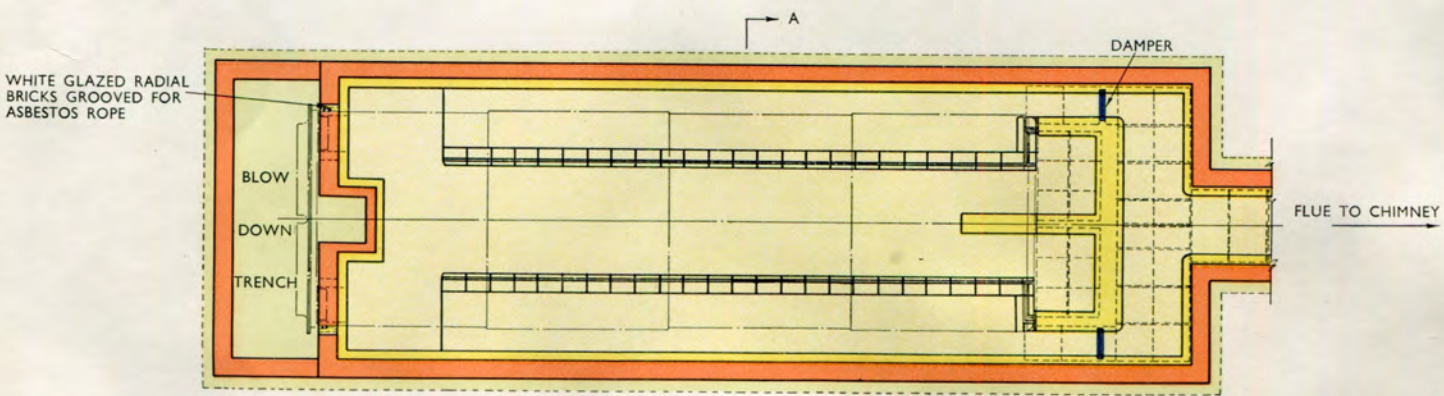
CROSS SECTION AA

FRONT ELEVATION

SECTION THROUGH DOWNTAKE CHAMBER



LONGITUDINAL SECTION



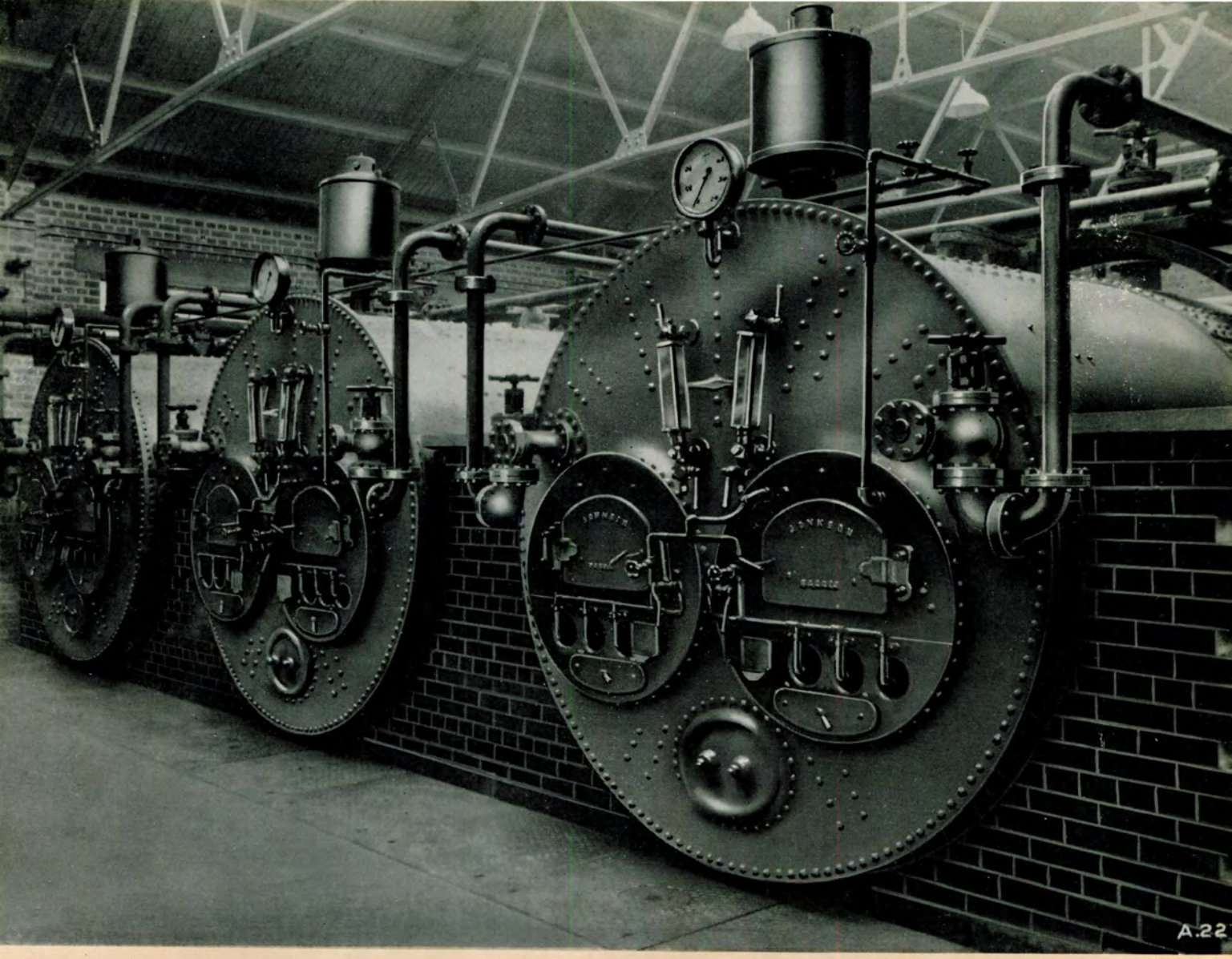
PLAN

DANKS of NETHERTON Ltd., NETHERTON · DUDLEY WORCS.

SIZES OF FLAT AND DISHED END LANCASHIRE BOILERS

with Heating Surfaces and Evaporations

Length and Diameter of Boiler.	Ex. Diam. of Two Flues.	Heating Surface of Boiler only.	Approximate Evaporations with ordinary Furnaces. Hand Fired. Natural Draught. .2″ to .3″ W.G. over Grate. Bituminous coal. 12,000 to 13,500 B.Th.U.s calorific value. Feed at 60°F.	212°F.	Approximate Evaporations Mechanical Stokers, Jets, Forced or Induced Draught. Bituminous coal. 12,000 to 13,500 B.Th.U.s calorific value. Feed at 60°F.	212°F.	Approximate Evaporations Natural Draught, .4″ to .5″ W.G. over Grate. Mechanical Stokers. Bituminous coal. 12,000 to 13,500 B.Th.U.s calorific value. Feed at 60°F.	212°F.	Approximate Evaporations Special Furnaces. Bituminous coal. 12,000 to 13,500 B.Th.U.s calorific value. Feed at 60°F.	212°F.
18′ 0″ × 6′ 6″	2′ 6″	505	2,880	3,460	3,490	4,190	3,140	3,770	3,180	3,820
20′ 0″ × 6′ 6″	2′ 6″	560	3,190	3,830	3,860	4,630	3,470	4,170	3,500	4,200
22′ 0″ × 6′ 6″	2′ 6″	620	3,530	4,230	4,280	5,130	3,850	4,610	3,890	4,660
24′ 0″ × 6′ 6″	2′ 6″	675	3,850	4,620	4,660	5,600	4,200	5,050	4,240	5,100
26′ 0″ × 6′ 6″	2′ 6″	735	4,190	5,050	5,070	6,080	4,560	5,470	4,630	5,550
24′ 0″ × 7′ 0″	2′ 9″	740	4,290	5,150	5,250	6,300	4,660	5,600	4,710	5,680
26′ 0″ × 7′ 0″	2′ 9″	800	4,640	5,570	5,680	6,800	5,050	6,050	5,100	6,110
28′ 0″ × 7′ 0″	2′ 9″	860	4,980	5,980	6,100	7,310	5,420	6,510	5,490	6,580
30′ 0″ × 7′ 0″	2′ 9″	925	5,370	6,450	6,570	7,900	5,820	7,000	5,900	7,090
24′ 0″ × 7′ 6″	3′ 0″	800	4,800	5,750	5,920	7,110	5,200	6,230	5,280	6,310
26′ 0″ × 7′ 6″	3′ 0″	870	5,220	6,280	6,440	7,720	5,560	6,700	5,740	6,900
28′ 0″ × 7′ 6″	3′ 0″	940	5,640	6,760	6,950	8,350	6,100	7,300	6,200	7,440
30′ 0″ × 7′ 6″	3′ 0″	1,000	6,000	7,200	7,400	8,880	6,500	7,800	6,600	7,910
24′ 0″ × 8′ 0″	3′ 3″	860	5,420	6,500	6,620	8,000	5,850	7,100	5,930	7,120
26′ 0″ × 8′ 0″	3′ 3″	935	5,900	7,090	7,200	8,650	6,360	7,610	6,500	7,810
28′ 0″ × 8′ 0″	3′ 3″	1,010	6,360	7,610	7,780	9,320	6,870	8,250	7,000	8,400
30′ 0″ × 8′ 0″	3′ 3″	1,085	6,850	8,220	8,350	10,020	7,380	8,860	7,520	9,040
24′ 0″ × 8′ 6″	3′ 6″	920	6,070	7,300	7,360	8,850	6,530	7,850	6,710	8,070
26′ 0″ × 8′ 6″	3′ 6″	1,000	6,600	7,900	8,000	9,600	7,100	8,510	7,250	8,700
28′ 0″ × 8′ 6″	3′ 6″	1,080	7,130	8,580	8,650	10,200	7,680	9,200	7,860	9,420
30′ 0″ × 8′ 6″	3′ 6″	1,160	7,650	9,200	9,280	11,140	8,250	9,900	8,420	10,080
24′ 0″ × 9′ 0″	3′ 9″	980	6,760	8,100	8,130	9,810	7,250	8,700	7,450	8,950
26′ 0″ × 9′ 0″	3′ 9″	1,070	7,400	8,900	8,880	10,680	7,920	9,510	8,150	9,800
28′ 0″ × 9′ 0″	3′ 9″	1,150	7,950	9,530	9,550	11,450	8,500	10,200	8,730	10,600
30′ 0″ × 9′ 0″	3′ 9″	1,230	8,500	10,200	10,200	12,250	9,100	10,930	9,380	11,200
24′ 0″ × 9′ 6″	4′ 0″	1,060	7,630	9,200	9,120	10,980	8,170	9,800	8,380	10,050
26′ 0″ × 9′ 6″	4′ 0″	1,140	8,200	9,810	9,800	11,800	8,800	10,600	9,010	10,820
28′ 0″ × 9′ 6″	4′ 0″	1,220	8,800	10,600	10,500	12,600	9,400	11,300	9,690	11,600
30′ 0″ × 9′ 6″	4′ 0″	1,310	9,450	11,350	11,270	13,520	10,100	12,120	10,400	12,500
24′ 0″ × 10′ 0″	4′ 0″	1,120	8,400	10,100	9,870	11,850	9,080	10,900	9,260	11,100
26′ 0″ × 10′ 0″	4′ 0″	1,220	9,150	11,000	10,850	13,000	9,880	11,810	10,020	12,050
28′ 0″ × 10′ 0″	4′ 0″	1,310	9,830	11,800	11,760	14,100	10,600	12,700	10,800	13,000
30′ 0″ × 10′ 0″	4′ 0″	1,385	10,400	12,500	12,320	14,800	11,200	13,450	11,410	13,800



A BATTERY OF THREE LANCASHIRE BOILERS

DANKS
OF NETHERTON
LIMITED
ESTABLISHED
1840

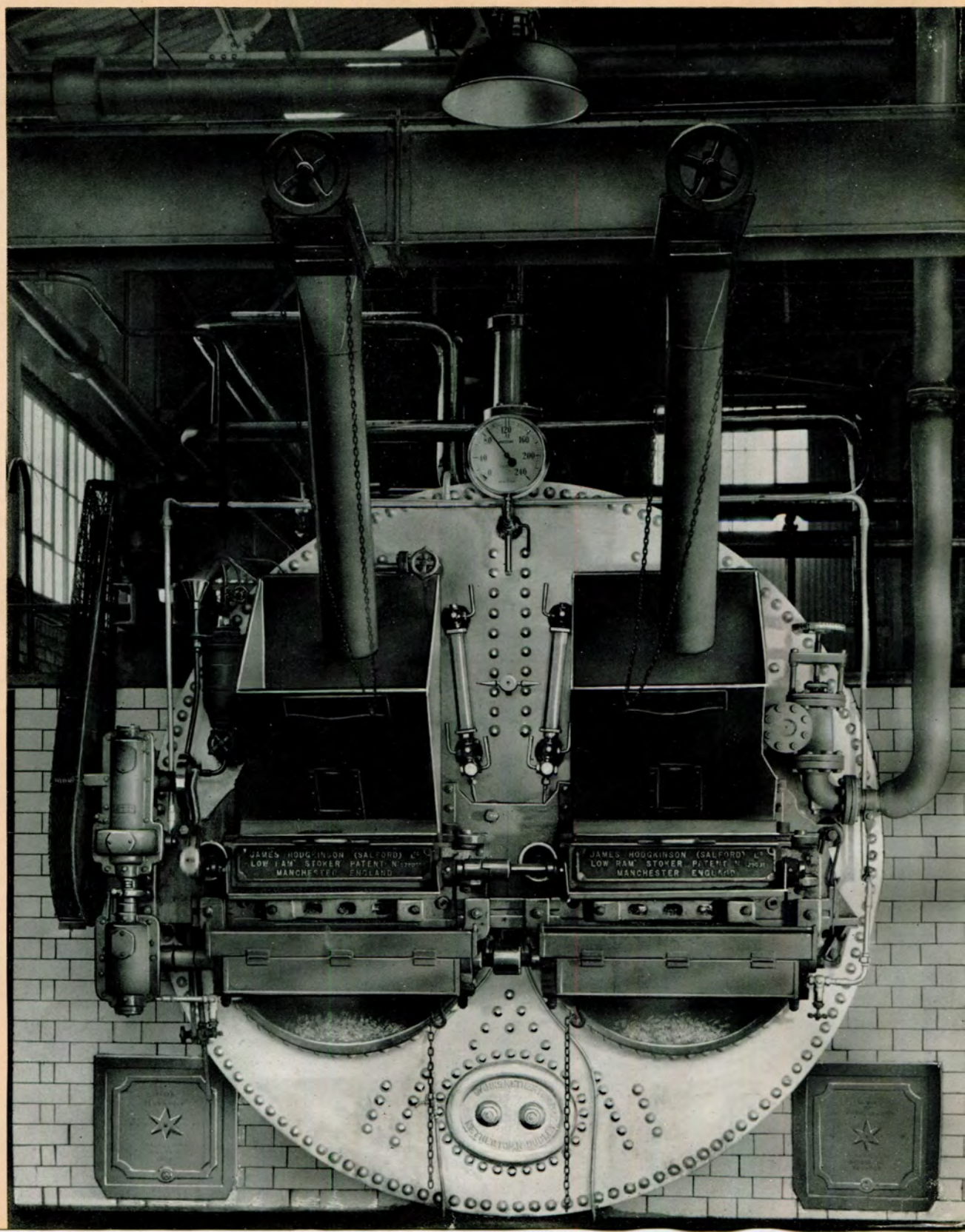
SIZES OF FLAT AND DISHED END LANCASHIRE BOILERS

with Heating Surfaces and Evaporations

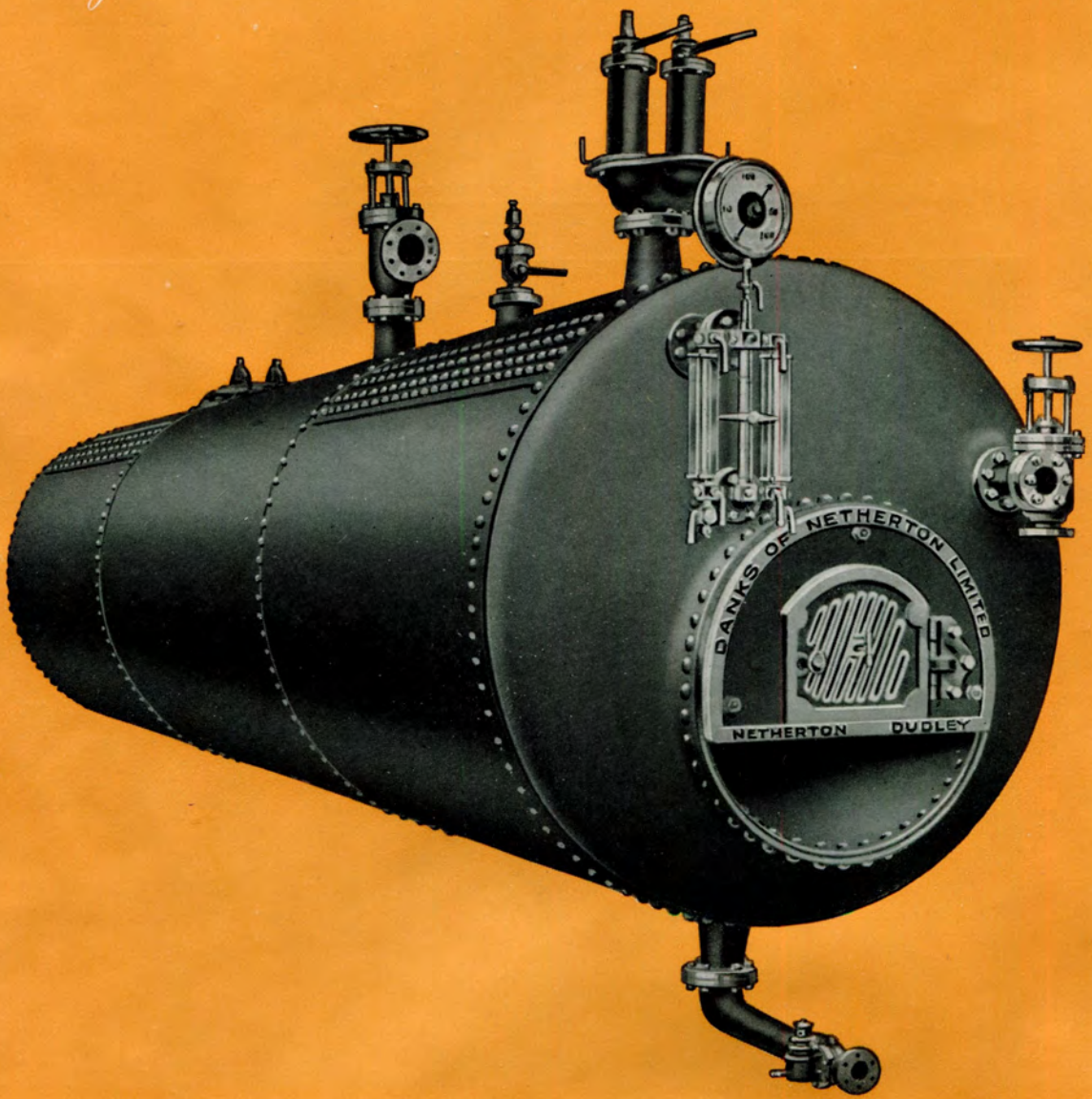
Length and Diameter of Boiler.	Ex. Diam. of Two Flues.	Heating Surface of Boiler only.	Approximate Evaporations with ordinary Furnaces. Hand Fired. Natural Draught. .2″ to .3″ W.G. over Grate. Bituminous coal. 12,000 to 13,500 B.Th.U.s calorific value. Feed at		Approximate Evaporations Mechanical Stokers, Jets, Forced or Induced Draught. Bituminous coal. 12,000 to 13,500 B.Th.U.s calorific value. Feed at		Approximate Evaporations Natural Draught, .4″ to .5″ W.G. over Grate. Mechanical Stokers. Bituminous coal. 12,000 to 13,500 B.Th.U.s calorific value. Feed at		Approximate Evaporations Special Furnaces. Bituminous coal. 12,000 to 13,500 B.Th.U.s calorific value. Feed at	
			60°F.	212°F.	60°F.	212°F.	60°F.	212°F.	60°F.	212°F.
18′ 0″ × 6′ 6″	2′ 6″	505	2,880	3,460	3,490	4,190	3,140	3,770	3,180	3,820
20′ 0″ × 6′ 6″	2′ 6″	560	3,190	3,830	3,860	4,630	3,470	4,170	3,500	4,200
22′ 0″ × 6′ 6″	2′ 6″	620	3,530	4,230	4,280	5,130	3,850	4,610	3,890	4,660
24′ 0″ × 6′ 6″	2′ 6″	675	3,850	4,620	4,660	5,600	4,200	5,050	4,240	5,100
26′ 0″ × 6′ 6″	2′ 6″	735	4,190	5,050	5,070	6,080	4,560	5,470	4,630	5,550
24′ 0″ × 7′ 0″	2′ 9″	740	4,290	5,150	5,250	6,300	4,660	5,600	4,710	5,680
26′ 0″ × 7′ 0″	2′ 9″	800	4,640	5,570	5,680	6,800	5,050	6,050	5,100	6,110
28′ 0″ × 7′ 0″	2′ 9″	860	4,980	5,980	6,100	7,310	5,420	6,510	5,490	6,580
30′ 0″ × 7′ 0″	2′ 9″	925	5,370	6,450	6,570	7,900	5,820	7,000	5,900	7,090
24′ 0″ × 7′ 6″	3′ 0″	800	4,800	5,750	5,920	7,110	5,200	6,230	5,280	6,310
26′ 0″ × 7′ 6″	3′ 0″	870	5,220	6,280	6,440	7,720	5,560	6,700	5,740	6,900
28′ 0″ × 7′ 6″	3′ 0″	940	5,640	6,760	6,950	8,350	6,100	7,300	6,200	7,440
30′ 0″ × 7′ 6″	3′ 0″	1,000	6,000	7,200	7,400	8,880	6,500	7,800	6,600	7,910
24′ 0″ × 8′ 0″	3′ 3″	860	5,420	6,500	6,620	8,000	5,850	7,100	5,930	7,120
26′ 0″ × 8′ 0″	3′ 3″	935	5,900	7,090	7,200	8,650	6,360	7,610	6,500	7,810
28′ 0″ × 8′ 0″	3′ 3″	1,010	6,360	7,610	7,780	9,320	6,870	8,250	7,000	8,400
30′ 0″ × 8′ 0″	3′ 3″	1,085	6,850	8,220	8,350	10,020	7,380	8,860	7,520	9,040
24′ 0″ × 8′ 6″	3′ 6″	920	6,070	7,300	7,360	8,850	6,530	7,850	6,710	8,070
26′ 0″ × 8′ 6″	3′ 6″	1,000	6,600	7,900	8,000	9,600	7,100	8,510	7,250	8,700
28′ 0″ × 8′ 6″	3′ 6″	1,080	7,130	8,580	8,650	10,200	7,680	9,200	7,860	9,420
30′ 0″ × 8′ 6″	3′ 6″	1,160	7,650	9,200	9,280	11,140	8,250	9,900	8,420	10,080
24′ 0″ × 9′ 0″	3′ 9″	980	6,760	8,100	8,130	9,810	7,250	8,700	7,450	8,950
26′ 0″ × 9′ 0″	3′ 9″	1,070	7,400	8,900	8,880	10,680	7,920	9,510	8,150	9,800
28′ 0″ × 9′ 0″	3′ 9″	1,150	7,950	9,530	9,550	11,450	8,500	10,200	8,730	10,600
30′ 0″ × 9′ 0″	3′ 9″	1,230	8,500	10,200	10,200	12,250	9,100	10,930	9,380	11,200
24′ 0″ × 9′ 6″	4′ 0″	1,060	7,630	9,200	9,120	10,980	8,170	9,800	8,380	10,050
26′ 0″ × 9′ 6″	4′ 0″	1,140	8,200	9,810	9,800	11,800	8,800	10,600	9,010	10,820
28′ 0″ × 9′ 6″	4′ 0″	1,220	8,800	10,600	10,500	12,600	9,400	11,300	9,690	11,600
30′ 0″ × 9′ 6″	4′ 0″	1,310	9,450	11,350	11,270	13,520	10,100	12,120	10,400	12,500
24′ 0″ × 10′ 0″	4′ 0″	1,120	8,400	10,100	9,870	11,850	9,080	10,900	9,260	11,100
26′ 0″ × 10′ 0″	4′ 0″	1,220	9,150	11,000	10,850	13,000	9,880	11,810	10,020	12,050
28′ 0″ × 10′ 0″	4′ 0″	1,310	9,830	11,800	11,760	14,100	10,600	12,700	10,800	13,000
30′ 0″ × 10′ 0″	4′ 0″	1,385	10,400	12,500	12,320	14,800	11,200	13,450	11,410	13,800

DANKS OF NETHERTON LIMITED
ESTABLISHED 1840

A MODERN LANCASHIRE BOILER INSTALLATION


JAMES HOUGHINSON (SALFORD) LTD
LOW RAM STOKER PATENT No 27907
MANCHESTER ENGLAND
JAMES HOUGHINSON (SALFORD) LTD
LOW RAM STOKER PATENT No 29031
MANCHESTER ENGLAND

DANKS *of* NETHERTON *Ltd.*, NETHERTON · DUDLEY WORCS.



CORNISH BOILERS

The Cornish Boiler is manufactured with either dished or flat ends, in sizes from 5′ 0″ to 6′ 6″ diam. for working pressures to suit requirements. This boiler has been widely adopted for small evaporations. Flue may be placed on or off the centre line as required.

We build brickwork settings and chimneys for these boilers as described in the Building section.

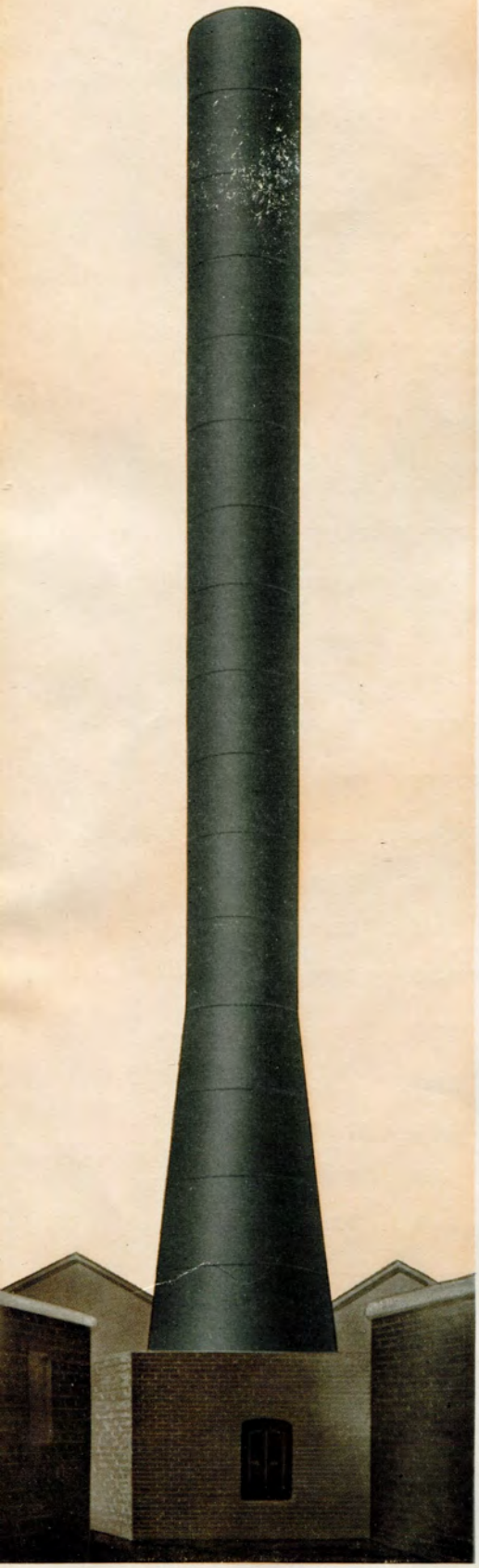
See list for standard sizes and evaporations.

DANKS OF NETHERTON LIMITED
ESTABLISHED 1840

SIZES OF FLAT AND DISHED END CORNISH BOILERS

with Heating Surfaces and Evaporations

Length and Diameter of Boiler.	Diam. of Flue.	Heating Surface of Boiler only.	Approximate Evaporations with ordinary Furnaces. Hand Fired. Natural Draught. .2″ to .3″ W.G. over Grate. Bituminous coal. 12,000 to 13,500 B.Th.U.s calorific value. Feed at 60°F.	212°F.	Approximate Evaporations Mechanical Stokers, Jets, Forced or Induced Draught. Bituminous coal. 12,000 to 13,500 B.Th.U.s calorific value. Feed at 60°F.	212°F.	Approximate Evaporations Natural Draught, .4″ to .5″ W.G. over Grate. Mechanical Stokers. Bituminous coal. 12,000 to 13,500 B.Th.U.s calorific value. Feed at 60°F.	212°F.	Approximate Evaporations Special Furnaces. Bituminous coal. 12,000 to 13,500 B.Th.U.s calorific value. Feed at 60°F.	212°F.
18′ 0″×5′ 0″	2′ 6″	320	1,640	1,960	1,960	2,350	1,765	2,120	1,800	2,160
20′ 0″×5′ 0″	2′ 6″	356	1,830	2,180	2,180	2,620	1,965	2,360	2,000	2,400
22′ 0″×5′ 0″	2′ 6″	392	2,010	2,400	2,400	2,880	2,160	2,600	2,200	2,640
24′ 0″×5′ 0″	2′ 6″	427	2,180	2,600	2,620	3,140	2,360	2,820	2,400	2,880
18′ 0″×5′ 6″	2′ 9″	352	1,860	2,230	2,230	2,670	2,010	2,410	2,050	2,460
20′ 0″×5′ 6″	2′ 9″	392	2,075	2,490	2,490	2,950	2,240	2,690	2,280	2,740
22′ 0″×5′ 6″	2′ 9″	426	2,280	2,730	2,730	3,280	2,460	2,950	2,500	3,000
24′ 0″×5′ 6″	2′ 9″	472	2,490	2,990	2,990	3,590	2,690	3,230	2,740	3,290
18′ 0″×6′ 0″	3′ 0″	390	2,150	2,580	2,580	3,100	2,320	2,780	2,360	2,830
20′ 0″×6′ 0″	3′ 0″	430	2,370	2,840	2,840	3,410	2,560	3,070	2,610	3,130
22′ 0″×6′ 0″	3′ 0″	470	2,580	3,100	3,100	3,720	2,800	3,360	2,820	3,380
24′ 0″×6′ 0″	3′ 0″	515	2,830	3,400	3,400	4,080	3,050	3,660	3,120	3,740
18′ 0″×6′ 6″	3′ 3″	420	2,400	2,880	2,880	3,460	2,590	3,110	2,640	3,170
20′ 0″×6′ 6″	3′ 3″	465	2,650	3,180	3,180	3,820	2,860	3,430	2,920	3,500
22′ 0″×6′ 6″	3′ 3″	510	2,910	3,500	3,500	4,200	3,140	3,770	3,200	3,840
24′ 0″×6′ 6″	3′ 3″	555	3,160	3,790	3,800	4,560	3,410	4,090	3,480	4,130

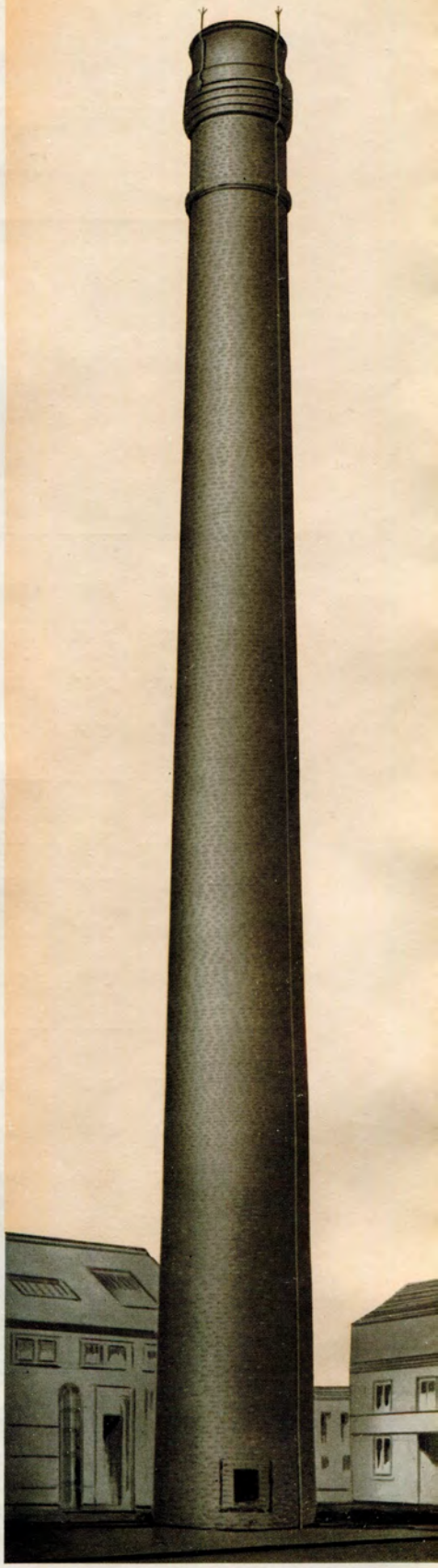


We build all types of Chimneys in brick or steel. Steel Chimneys are of the self-supporting or guyed type and designed to suit customers' requirements.

Opposite page gives approximate size of Chimneys for Lancashire Boilers under hand-firing conditions.

For any other conditions we would be pleased to advise.

Enquiries should state size of boiler, type of grate and area, etc.



DANKS *of* NETHERTON *Ltd.*, NETHERTON · DUDLEY WORCS.

DANKS OF NETHERTON LIMITED
ESTABLISHED 1840

APPROXIMATE SIZE OF CHIMNEYS FOR LANCASHIRE BOILERS FOR HAND-FIRED NATURAL DRAUGHT

Size of Boiler	Evaporation in lbs. From and at 212°F.	No. of Boilers			
		1	2	3	4
26′ 0″ × 6′ 6″	5,050	2′ 9″ dia. × 75′ 0″ high	3′ 6″ dia. × 90′ 0″ high	4′ 3″ dia. × 100′ 0″ high	5′ 0″ dia. × 100′ 0″ high
30′ 0″ × 7′ 0″	6,450	3′ 0″ dia. × 75′ 0″ high	4′ 0″ dia. × 90′ 0″ high	4′ 9″ dia. × 100′ 0″ high	5′ 6″ dia. × 110′ 0″ high
30′ 0″ × 7′ 6″	7,200	3′ 0″ dia. × 80′ 0″ high	4′ 3″ dia. × 90′ 0″ high	5′ 0″ dia. × 110′ 0″ high	6′ 0″ dia. × 110′ 0″ high
30′ 0″ × 8′ 0″	8,220	3′ 3″ dia. × 80′ 0″ high	4′ 6″ dia. × 100′ 0″ high	5′ 6″ dia. × 120′ 0″ high	6′ 3″ dia. × 120′ 0″ high
30′ 0″ × 8′ 6″	9,200	3′ 6″ dia. × 80′ 0″ high	4′ 9″ dia. × 100′ 0″ high	5′ 9″ dia. × 120′ 0″ high	6′ 6″ dia. × 130′ 0″ high
30′ 0″ × 9′ 0″	10,200	3′ 9″ dia. × 90′ 0″ high	5′ 0″ dia. × 100′ 0″ high	6′ 0″ dia. × 120′ 0″ high	6′ 9″ dia. × 130′ 0″ high
30′ 0″ × 9′ 6″	11,350	4′ 0″ dia. × 100′ 0″ high	5′ 3″ dia. × 110′ 0″ high	6′ 3″ dia. × 130′ 0″ high	6′ 9″ dia. × 150′ 0″ high
30′ 0″ × 10′ 0″	12,500	4′ 0″ dia. × 100′ 0″ high	5′ 6″ dia. × 110′ 0″ high	6′ 6″ dia. × 130′ 0″ high	7′ 0″ dia. × 150′ 0″ high

DANKS OF NETHERTON LIMITED
ESTABLISHED 1840

BRICK SET ECONOMIC BOILER

The Brick-set Economic boiler is a very compact unit, and is used considerably by some branches of Industry. It occupies less space and is cheaper to instal than a Lancashire boiler for equal evaporation.

The heating surface is composed of furnace flues and tubes, distributed throughout the water space, and the outside of the shell of the boiler in the way of the brickwork setting flues. The gases from the grate pass over the bridge, along the flues into the firebrick lined combustion chamber of the setting at the rear of the boiler, return to the front end through small return tubes to the smokebox, from which they pass into the flues of the brickwork setting and along the boiler shell to the chimney.

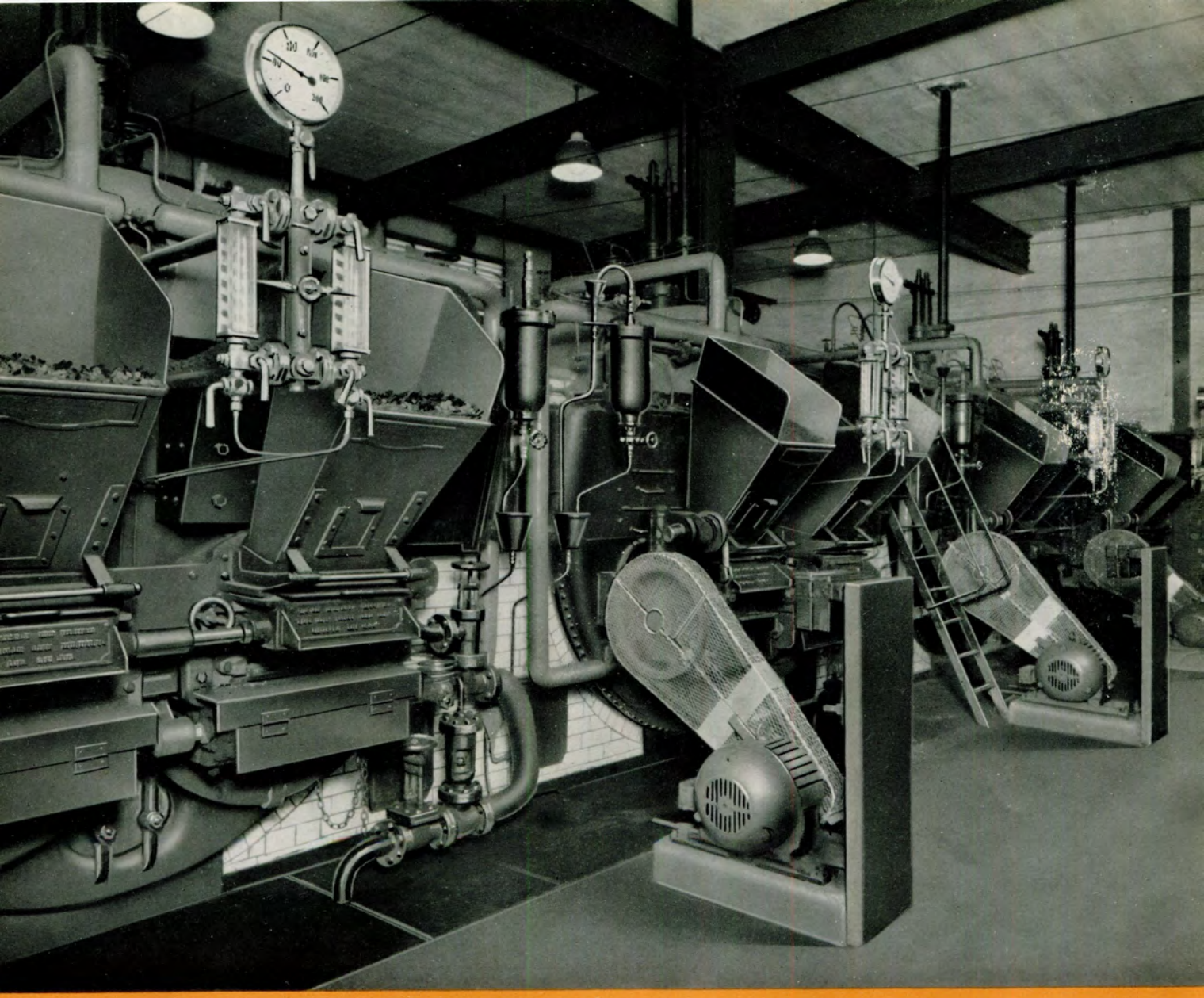
With this arrangement full advantage is taken of the gases, which give up still more of their heat, and leave the boiler at a lower temperature, than with a Lancashire boiler.

DANKS OF NETHERTON LIMITED
ESTABLISHED 1840

BRICK-SET ECONOMIC BOILER

Evaporation in lbs. per hour		Diameter of Boiler	Length over Tube Plates	Flues		Heating Surface in sq. ft.
From Feed at 60°F.	From and at 212°F.			No.	Size	
2,100	2,520	6′ 0″	9′ 6″	1	3′ 0″	420
2,425	2,910	6′ 3″	11′ 0″	1	3′ 3″	485
2,950	3,540	6′ 6″	12′ 6″	1	3′ 3″	590
3,450	4,140	7′ 0″	12′ 6″	1	3′ 6″	690
4,475	5,370	7′ 6″	14′ 0″	1	3′ 9″	895
5,875	7,050	8′ 0″	14′ 0″	1	4′ 0″	1,175
6,700	8,040	8′ 6″	14′ 0″	2	2′ 9″	1,340
7,650	9,180	8′ 9″	15′ 6″	2	3′ 0″	1,530
8,370	10,044	9′ 0″	15′ 6″	2	3′ 0″	1,674
9,130	10,956	9′ 6″	15′ 6″	2	3′ 3″	1,826
10,250	12,300	9′ 9″	15′ 6″	2	3′ 3″	2,050
11,085	13,302	10′ 0″	16′ 0″	2	3′ 6″	2,217
12,555	15,066	10′ 6″	16′ 0″	2	3′ 6″	2,511
13,440	16,128	11′ 0″	16′ 0″	2	3′ 9″	2,688
15,050	18,060	11′ 6″	16′ 0″	2	4′ 0″	3,010
17,050	20,460	12′ 0″	16′ 0″	2	4′ 3″	3,410

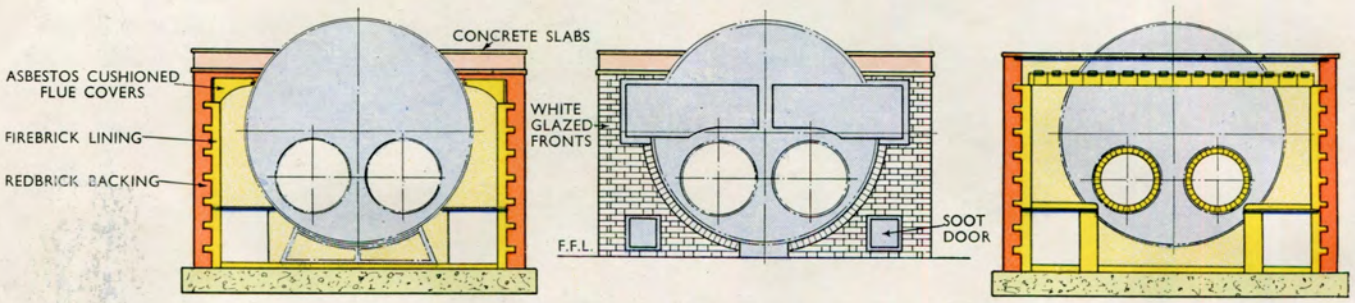
The above evaporations are based on boilers fitted with mechanical stokers and fired with coal having a calorific value of not less than 12,000 B.Th.U.s/lb.



BATTERY OF
BRICK-SET ECONOMIC BOILERS

DANKS *of* NETHERTON *Ltd.*, NETHERTON · DUDLEY WORCS.

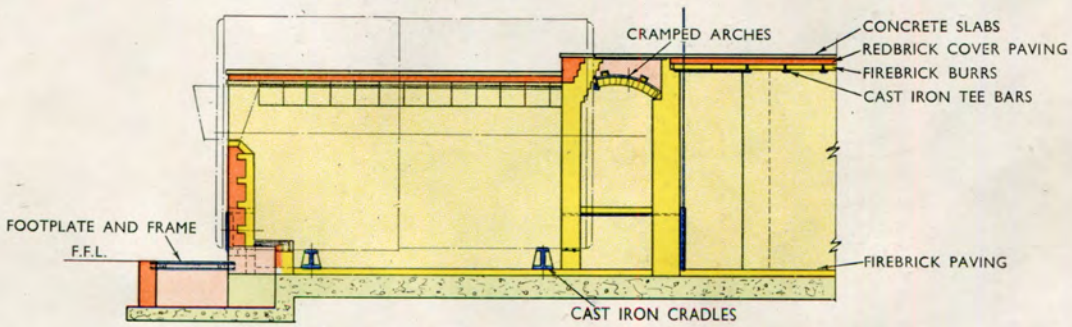
BRICK-SET ECONOMIC BOILER



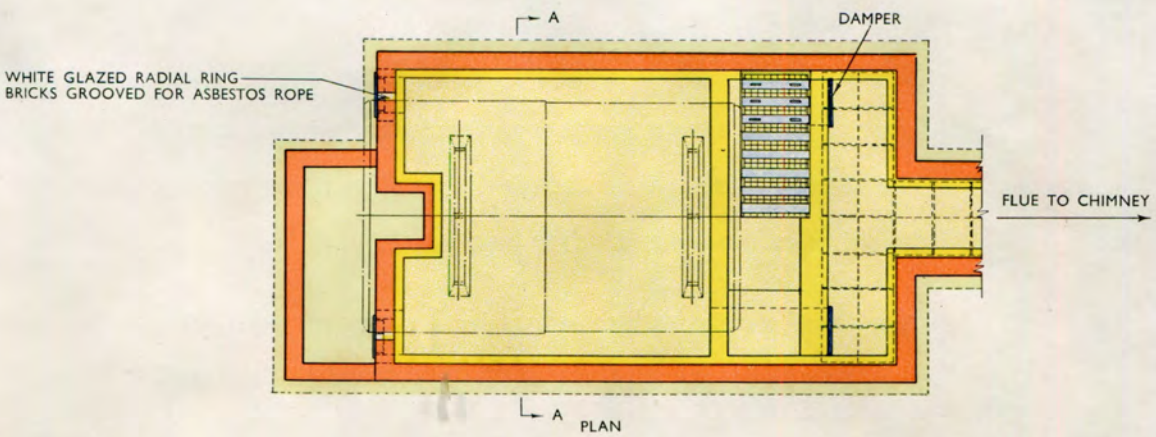
CROSS SECTION AA

FRONT ELEVATION

SECTION THROUGH COMBUSTION CHAMBER



LONGITUDINAL SECTION



PLAN

DANKS of NETHERTON Ltd., NETHERTON · DUDLEY WORCS.

DANKS OF NETHERTON LIMITED
ESTABLISHED 1840

BUILDING DEPARTMENT

We have our own staff of specialists skilled in the design and construction of all types of building, including :

- Foundation Work.
- Boiler Houses.
- Brick Chimneys.
- Boiler Settings.
- Economiser settings.
- Refractory linings and construction.
- Flues, Repairs, etc.

We also hold large stocks of refractory materials and can supply spares promptly if required.

We execute contracts in all parts of the British Isles, starting from virgin ground and finishing with steam in the factory. We will advise clients on all matters relating to chimney, boiler and other brickwork.

We are the only boiler makers in the country who carry out complete installations with our own skilled staff.

USEFUL TECHNICAL DATA

EVAPORATIONS OF BOILERS

For comparing two boilers of different pressure and conditions, a standard has been adopted known as "evaporation from and at 212 degs. Fah. or equivalent evaporation". This is based on the actual evaporation per pound of fuel, multiplied by the factor of evaporation.

The factor of evaporation is the figure given by dividing the total heat of the steam at working conditions by the latent heat of steam at atmospheric pressure, or 0 lb. per square inch gauge pressure—i.e., 970 B.Th.U.'s.

$$\text{Factor of evaporation} = \frac{(H + 32) - T}{970}$$

Where H = Total heat in one pound of steam at working pressure above 32 degs. Fah. (taken from steam table).

T = Temperature of Feed Water.

970 = British Thermal Units, the latent heat of steam at atmospheric conditions.

DANKS OF NETHERTON LIMITED
ESTABLISHED 1840

FACTORS OF EVAPORATION

Temperature of Feed Water in F.°	Boiler Pressure in lbs. per sq. inch										
	60	80	100	120	140	160	180	200	220	240	260
40	1.209	1.214	1.217	1.220	1.223	1.225	1.226	1.228	1.229	1.231	1.232
50	1.199	1.203	1.206	1.210	1.212	1.214	1.216	1.218	1.219	1.220	1.221
60	1.188	1.193	1.196	1.198	1.202	1.204	1.206	1.207	1.209	1.210	1.211
70	1.178	1.183	1.186	1.189	1.192	1.194	1.195	1.197	1.198	1.199	1.201
80	1.168	1.172	1.176	1.179	1.182	1.183	1.185	1.187	1.188	1.189	1.190
90	1.158	1.162	1.166	1.168	1.171	1.173	1.175	1.176	1.178	1.179	1.180
100	1.147	1.152	1.155	1.158	1.161	1.163	1.166	1.166	1.168	1.169	1.170
110	1.137	1.142	1.145	1.148	1.151	1.153	1.154	1.156	1.157	1.158	1.160
120	1.127	1.131	1.135	1.138	1.140	1.142	1.144	1.146	1.147	1.148	1.149
130	1.116	1.121	1.125	1.127	1.130	1.132	1.134	1.135	1.137	1.138	1.139
140	1.106	1.111	1.114	1.117	1.120	1.122	1.123	1.125	1.126	1.128	1.129
150	1.096	1.100	1.104	1.106	1.109	1.111	1.113	1.115	1.116	1.117	1.118
160	1.085	1.090	1.093	1.096	1.099	1.100	1.103	1.104	1.106	1.107	1.108
170	1.075	1.079	1.083	1.086	1.089	1.091	1.092	1.094	1.095	1.097	1.098
180	1.065	1.069	1.073	1.076	1.078	1.080	1.082	1.084	1.085	1.087	1.087
190	1.054	1.059	1.062	1.065	1.068	1.069	1.072	1.073	1.075	1.076	1.077
200	1.044	1.048	1.052	1.055	1.057	1.059	1.061	1.063	1.064	1.066	1.067
210	1.034	1.038	1.042	1.045	1.047	1.049	1.051	1.052	1.054	1.055	1.056

EXAMPLE :—

Average steam pressure = 100 lb. per square inch.
Average feed temperature = 100 degs. Fah.

$$\text{Factor of evaporation} = \frac{(1190{\cdot}7 + 32) - 100}{970} = 1{\cdot}155$$

If the actual evaporation of the boiler is 6,066 lb. per hour from feed at 100 degs. Fah. and at 100 lb. per sq. inch working pressure—

Equivalent evaporation from and at 212° Fah. = $6066 \times 1{\cdot}155$ = 7,000 lb.

Or—

$$6066 \times \frac{(1190{\cdot}7 + 32) - 100}{970} = 7{,}000 \text{ lb.}$$

If the steam is superheated the total heat—H, will be increased by $C_P(T_2 - T_1)$

C_P = mean specific heat of superheated steam.

T_2 = temperature of superheated steam.

T_1 = temperature of saturated steam at given working pressure.

MEAN SPECIFIC HEATS OF SUPERHEATED STEAM

Pressure lbs. per sq. in. Gauge	50°F.	100°F.	150°F.	200°F.	250°F.
60	.526	.517	.507	.504	.500
80	.545	.531	.513	.513	.508
100	.562	.543	.524	.521	.514
120	.580	.554	.538	.528	.521
150	.604	.571	.548	.537	.528
160	.614	.577	.553	.541	.533
170	.622	.582	.556	.544	.536
180	.630	.588	.560	.547	.537
190	.638	.593	.563	.550	.540
200	.648	.597	.568	.554	.543
225	.664	.608	.577	.558	.548
230	.674	.613	.582	.561	.551

Factor of evaporation would then become $\dfrac{[(H + 32) - T] + [C_P(T_2 + T_1)]}{970}$

Taking previous example with final steam temperature at 488° F. then factor of evaporation

$$= \frac{[(1190{\cdot}7 + 32) - 100] + [{\cdot}524\ (488 - 338)]}{970}$$

$$= 1{\cdot}238$$

Therefore, equivalent evaporation from and at 212 degs. Fah. would become—

$$6066 \times 1{\cdot}238$$

$$= 7{,}510 \text{ lbs.}$$

Or—

$$6066 \times \frac{[(1190{\cdot}7 + 32) - 100] + [{\cdot}524\ (488 - 338)]}{970}$$

$$= 7{,}510 \text{ lbs.}$$

DANKS OF NETHERTON LIMITED
ESTABLISHED 1840

STEAM TABLES

Based on the Callendar Steam Tables, London : Edward Arnold (Publishers) Ltd.

Abs. p. lbs. per sq. in.	Vacuum inches	Temp. °F.	Heat in Mean British Thermal Units per lb. from 32°F.			Entropy. Ranks per lb.		Volume. cu. ft. per lb. Dry Sat.
			Water, total heat	Latent heat of vapori-sation	Steam, total heat	Water	Steam	
0.5	28.99	79.6	47.5	1048.5	1096.1	0.0924	2.0367	643.0
0.55	28.89	82.5	50.4	1046.9	1097.4	0.0978	2.0288	587.0
0.6	28.79	85.3	53.1	1045.4	1098.6	0.1028	2.0214	540.6
0.65	28.68	87.8	55.6	1044.0	1099.7	0.1073	2.0143	500.8
0.7	28.58	90.1	57.8	1042.7	1100.8	0.1117	2.0082	466.6
0.75	28.48	92.3	60.1	1041.5	1101.8	0.1156	2.0025	437.3
0.8	28.38	94.4	62.3	1040.3	1102.7	0.1196	1.9970	411.7
0.85	28.27	96.3	64.2	1039.2	1103.5	0.1230	1.9919	388.9
0.9	28.17	98.2	66.0	1038.1	1104.3	0.1264	1.9871	368.7
0.95	28.07	100.0	67.8	1037.1	1105.1	0.1296	1.9826	350.5
1.0	27.97	101.7	69.5	1036.1	1105.8	0.1326	1.9783	334.0
1.05	27.86	103.3	71.1	1035.2	1106.5	0.1353	1.9742	318.9
1.1	27.76	104.9	72.7	1034.3	1107.2	0.1381	1.9702	305.2
1.15	27.66	106.4	74.2	1033.4	1107.8	0.1407	1.9665	292.6
1.2	27.56	107.9	75.6	1032.5	1108.4	0.1433	1.9630	281.1
1.25	27.46	109.4	77.1	1031.7	1109.0	0.1460	1.9596	270.4
1.3	27.35	110.7	78.4	1030.9	1109.6	0.1484	1.9563	260.5
1.35	27.25	112.0	79.7	1030.2	1110.2	0.1506	1.9532	251.4
1.4	27.15	113.3	81.1	1029.5	1110.8	0.1527	1.9501	243.0
1.45	27.05	114.5	82.2	1028.8	1111.3	0.1548	1.9471	235.2
1.5	26.95	115.7	83.4	1028.1	1111.8	0.1569	1.9442	228.0
1.6	26.74	118.0	85.7	1026.8	1112.8	0.1609	1.9387	214.3
1.7	26.54	120.2	87.9	1025.5	1113.7	0.1646	1.9336	202.5
1.8	26.33	122.2	89.9	1024.4	1114.6	0.1681	1.9288	191.8
1.9	26.13	124.2	91.9	1023.3	1115.4	0.1715	1.9243	182.3
2.0	25.92	126.1	93.8	1022.2	1116.2	0.1749	1.9200	173.7
2.2	25.51	129.6	97.3	1020.2	1117.7	0.1809	1.9120	158.8
2.4	25.11	132.9	100.6	1018.3	1119.1	0.1864	1.9047	146.4
2.6	24.70	135.9	103.6	1016.5	1120.3	0.1916	1.8981	135.8
2.8	24.29	138.8	106.4	1014.8	1121.5	0.1963	1.8920	126.7
3.0	23.88	141.5	109.1	1013.2	1122.6	0.2008	1.8869	118.7
3.2	23.47	144.0	111.7	1011.7	1123.7	0.2050	1.8819	111.7
3.4	23.07	146.4	114.1	1010.3	1124.7	0.2091	1.8770	105.5
3.6	22.66	148.7	116.4	1009.0	1125.7	0.2128	1.8722	100.0
3.8	22.25	150.9	118.5	1007.8	1126.7	0.2164	1.8676	95.10
4.0	21.84	153.0	120.6	1006.7	1127.7	0.2199	1.8632	90.63
4.2	21.43	155.0	122.6	1005.6	1128.6	0.2231	1.8590	86.58
4.4	21.02	156.9	124.5	1004.6	1129.5	0.2262	1.8552	82.88
4.6	20.61	158.8	126.4	1003.6	1130.3	0.2292	1.8516	79.50
4.8	20.21	160.6	128.1	1002.6	1131.1	0.2321	1.8482	76.39
5.0	19.80	162.3	129.8	1001.6	1131.8	0.2348	1.8449	73.52
5.2	19.39	163.9	131.5	1000.6	1132.5	0.2374	1.8417	70.88
5.4	18.98	165.5	133.2	999.6	1133.1	0.2401	1.8386	68.41
5.6	18.57	167.1	134.7	998.6	1133.7	0.2426	1.8356	66.12
5.8	18.17	168.6	136.2	997.6	1134.2	0.2450	1.8327	63.98

DANKS *of* NETHERTON *Ltd.*, NETHERTON · DUDLEY WORCS.

STEAM TABLES *(contd.)*

Abs. p. lbs. per sq. in.	Vacuum inches	Temp. °F.	Heat in Mean British Thermal Units per lb. from 32°F.			Entropy. Ranks per lb.		Volume. cu. ft. per lb. Dry Sat.
			Water, total heat	Latent heat of vaporisation	Steam, total heat	Water	Steam	
6.0	17.76	170.1	137.6	996.6	1134.7	0.2473	1.8299	61.98
6.5	16.74	173.6	141.1	994.3	1135.9	0.2529	1.8236	57.50
7.0	15.71	176.9	144.4	992.2	1137.1	0.2582	1.8176	53.64
7.5	14.69	180.0	147.5	990.3	1138.3	0.2631	1.8119	50.30
8.0	13.67	182.9	150.4	988.5	1139.5	0.2676	1.8065	47.35
8.5	12.65	185.7	153.2	986.8	1140.6	0.2719	1.8015	44.73
9.0	11.63	188.3	155.9	985.2	1141.7	0.2762	1.7968	42.40
9.5	10.61	190.8	158.3	983.8	1142.7	0.2801	1.7925	40.31
10.0	9.59	193.2	160.7	982.5	1143.8	0.2836	1.7884	38.42
10.5	8.57	195.6	163.0	981.1	1144.7	0.2872	1.7845	36.71
11.0	7.55	197.8	165.2	979.6	1145.5	0.2906	1.7807	35.14
11.5	6.52	199.9	167.4	978.2	1146.3	0.2939	1.7771	33.71
12.0	5.50	202.0	169.4	976.9	1147.0	0.2970	1.7735	32.40
12.5	4.48	204.0	171.4	975.7	1147.7	0.3001	1.7703	31.17
13.0	3.46	205.9	173.3	974.6	1148.5	0.3029	1.7672	30.05
13.5	2.44	207.8	175.2	973.4	1149.2	0.3059	1.7642	29.01
14.0	1.42	209.6	177.0	972.2	1149.9	0.3086	1.7613	28.03
14.5	0.40	211.3	178.8	971.0	1150.5	0.3112	1.7585	27.12
14.696	Gauge lbs./sq.in.	212.0	179.4	970.6	1150.7	0.3122	1.7574	26.80
15	0.3	213.0	180.4	970.0	1151.2	0.3137	1.7556	26.28
16	1.3	216.3	183.7	967.9	1152.4	0.3187	1.7505	24.74
17	2.3	219.5	186.8	965.9	1153.5	0.3231	1.7456	23.38
18	3.3	222.4	189.8	964.0	1154.6	0.3276	1.7411	22.17
19	4.3	225.2	192.6	962.2	1155.7	0.3319	1.7368	21.07
20	5.3	228.0	195.3	960.4	1156.7	0.3358	1.7327	20.09
21	6.3	230.6	197.9	958.8	1157.7	0.3396	1.7287	19.19
22	7.3	233.1	200.4	957.2	1158.6	0.3433	1.7250	18.38
23	8.3	235.5	202.8	955.6	1159.5	0.3468	1.7215	17.63
24	9.3	237.8	205.1	954.0	1160.3	0.3502	1.7181	16.94
25	10.3	240.1	207.4	952.5	1161.1	0.3534	1.7148	16.30
26	11.3	242.2	209.5	951.1	1161.9	0.3565	1.7118	15.72
27	12.3	244.4	211.6	949.7	1162.6	0.3595	1.7089	15.17
28	13.3	246.4	213.7	948.3	1163.3	0.3625	1.7060	14.67
29	14.3	248.4	215.7	947.0	1164.0	0.3654	1.7032	14.19
30	15.3	250.3	217.6	945.6	1164.6	0.3682	1.7004	13.73
31	16.3	252.2	219.5	944.3	1165.2	0.3709	1.6977	13.31
32	17.3	254.0	221.3	943.1	1165.8	0.3735	1.6952	12.93
33	18.3	255.8	223.1	941.9	1166.4	0.3760	1.6928	12.56
34	19.3	257.6	224.9	940.7	1167.0	0.3785	1.6905	12.21
35	20.3	259.3	226.6	939.6	1167.6	0.3809	1.6883	11.89
36	21.3	260.9	228.2	938.5	1168.2	0.3833	1.6860	11.58
37	22.3	262.5	229.8	937.4	1168.8	0.3856	1.6838	11.29
38	23.3	264.1	231.4	936.4	1169.4	0.3879	1.6817	11.02
39	24.3	265.7	232.9	935.4	1170.0	0.3901	1.6796	10.76

STEAM TABLES *(contd.)*

Abs. p. lbs. per sq. in.	Vacuum inches	Temp. °F.	Heat in Mean British Thermal Units per lb. from 32°F.			Entropy. Ranks per lb.		Volume. cu. ft. per lb. Dry Sat.
			Water, total heat	Latent heat of vaporisation	Steam, total heat	Water	Steam	
40	25.3	267.2	234.4	934.4	1170.5	0.3923	1.6776	10.50
42	27.3	270.3	237.4	932.3	1171.4	0.3964	1.6737	10.03
44	29.3	273.1	240.3	930.3	1172.3	0.4003	1.6700	9.600
46	31.3	275.8	243.0	928.3	1173.2	0.4041	1.6664	9.209
48	33.3	278.5	245.7	926.4	1174.0	0.4077	1.6630	8.848
50	35.3	281.0	248.2	924.6	1174.8	0.4112	1.6597	8.516
52	37.3	283.5	250.7	922.9	1175.6	0.4146	1.6566	8.208
54	39.3	285.9	253.1	921.1	1176.3	0.4179	1.6536	7.922
56	41.3	288.3	255.4	919.4	1177.0	0.4211	1.6507	7.656
58	43.3	290.5	257.7	917.8	1177.7	0.4242	1.6478	7.407
60	45.3	292.7	259.8	916.2	1178.4	0.4272	1.6450	7.175
62	47.3	294.9	262.0	914.6	1179.0	0.4302	1.6423	6.957
64	49.3	296.9	264.0	913.1	1179.6	0.4331	1.6398	6.752
66	51.3	299.0	266.1	911.6	1180.2	0.4359	1.6374	6.560
68	53.3	301.0	268.1	910.1	1180.8	0.4386	1.6350	6.378
70	55.3	302.9	270.0	908.7	1181.4	0.4412	1.6327	6.206
72	57.3	304.8	271.9	907.4	1182.0	0.4437	1.6304	6.044
74	59.3	306.7	273.8	906.0	1182.5	0.4462	1.6282	5.890
76	61.3	308.5	275.6	904.6	1183.0	0.4486	1.6261	5.743
78	63.3	310.3	277.4	903.2	1183.5	0.4510	1.6240	5.604
80	65.3	312.0	279.0	901.9	1184.0	0.4533	1.6219	5.472
82	67.3	313.7	280.7	900.6	1184.5	0.4556	1.6199	5.346
84	69.3	315.4	282.4	899.4	1185.0	0.4579	1.6180	5.226
86	71.3	317.1	284.1	898.1	1185.4	0.4601	1.6161	5.110
88	73.3	318.7	285.7	896.8	1185.8	0.4622	1.6142	5.000
90	75.3	320.3	287.3	895.5	1186.2	0.4643	1.6124	4.896
92	77.3	321.9	288.9	894.3	1186.6	0.4664	1.6106	4.796
94	79.3	323.3	290.3	893.1	1187.0	0.4684	1.6088	4.699
96	81.3	324.8	291.8	891.9	1187.4	0.4704	1.6071	4.607
98	83.3	326.3	293.3	890.8	1187.8	0.4723	1.6054	4.519
100	85.3	327.8	294.8	889.7	1188.2	0.4742	1.6038	4.434
105	90.3	331.3	298.3	886.9	1189.1	0.4789	1.6000	4.230
110	95.3	334.8	301.8	884.2	1189.9	0.4833	1.5963	4.046
115	100.3	338.1	305.1	881.5	1190.7	0.4876	1.5927	3.880
120	105.3	341.3	308.3	878.9	1191.4	0.4918	1.5891	3.729
125	110.3	344.4	311.4	876.4	1192.1	0.4958	1.5856	3.587
130	115.3	347.3	314.3	874.0	1192.8	0.4997	1.5823	3.456
135	120.3	350.2	317.1	871.5	1193.4	0.5035	1.5792	3.335
140	125.3	353.0	319.9	869.1	1194.0	0.5071	1.5762	3.222
145	130.3	355.8	322.7	866.8	1194.6	0.5106	1.5733	3.116
150	135.3	358.4	325.3	864.5	1195.1	0.5140	1.5705	3.015
155	140.3	361.0	327.9	862.3	1195.6	0.5173	1.5678	2.922
160	145.3	363.6	330.5	860.1	1196.1	0.5205	1.5652	2.835
165	150.3	366.0	332.9	858.0	1196.6	0.5236	1.5627	2.754
170	155.3	368.4	335.3	855.9	1197.1	0.5267	1.5602	2.677

STEAM TABLES *(contd.)*

Abs. p. lbs. per sq. in.	Vacuum inches	Temp. °F.	Heat in Mean British Thermal Units per lb. from 32°F.			Entropy. Ranks per lb.		Volume. cu. ft. per lb. Dry Sat.
			Water, total heat	Latent heat of vaporisation	Steam, total heat	Water	Steam	
6.0	17.76	170.1	137.6	996.6	1134.7	0.2473	1.8299	61.98
6.5	16.74	173.6	141.1	994.3	1135.9	0.2529	1.8236	57.50
7.0	15.71	176.9	144.4	992.2	1137.1	0.2582	1.8176	53.64
7.5	14.69	180.0	147.5	990.3	1138.3	0.2631	1.8119	50.30
8.0	13.67	182.9	150.4	988.5	1139.5	0.2676	1.8065	47.35
8.5	12.65	185.7	153.2	986.8	1140.6	0.2719	1.8015	44.73
9.0	11.63	188.3	155.9	985.2	1141.7	0.2762	1.7968	42.40
9.5	10.61	190.8	158.3	983.8	1142.7	0.2801	1.7925	40.31
10.0	9.59	193.2	160.7	982.5	1143.8	0.2836	1.7884	38.42
10.5	8.57	195.6	163.0	981.1	1144.7	0.2872	1.7845	36.71
11.0	7.55	197.8	165.2	979.6	1145.5	0.2906	1.7807	35.14
11.5	6.52	199.9	167.4	978.2	1146.3	0.2939	1.7771	33.71
12.0	5.50	202.0	169.4	976.9	1147.0	0.2970	1.7735	32.40
12.5	4.48	204.0	171.4	975.7	1147.7	0.3001	1.7703	31.17
13.0	3.46	205.9	173.3	974.6	1148.5	0.3029	1.7672	30.05
13.5	2.44	207.8	175.2	973.4	1149.2	0.3059	1.7642	29.01
14.0	1.42	209.6	177.0	972.2	1149.9	0.3086	1.7613	28.03
14.5	0.40	211.3	178.8	971.0	1150.5	0.3112	1.7585	27.12
14.696	Gauge lbs./sq.in.	212.0	179.4	970.6	1150.7	0.3122	1.7574	26.80
15	0.3	213.0	180.4	970.0	1151.2	0.3137	1.7556	26.28
16	1.3	216.3	183.7	967.9	1152.4	0.3187	1.7505	24.74
17	2.3	219.5	186.8	965.9	1153.5	0.3231	1.7456	23.38
18	3.3	222.4	189.8	964.0	1154.6	0.3276	1.7411	22.17
19	4.3	225.2	192.6	962.2	1155.7	0.3319	1.7368	21.07
20	5.3	228.0	195.3	960.4	1156.7	0.3358	1.7327	20.09
21	6.3	230.6	197.9	958.8	1157.7	0.3396	1.7287	19.19
22	7.3	233.1	200.4	957.2	1158.6	0.3433	1.7250	18.38
23	8.3	235.5	202.8	955.6	1159.5	0.3468	1.7215	17.63
24	9.3	237.8	205.1	954.0	1160.3	0.3502	1.7181	16.94
25	10.3	240.1	207.4	952.5	1161.1	0.3534	1.7148	16.30
26	11.3	242.2	209.5	951.1	1161.9	0.3565	1.7118	15.72
27	12.3	244.4	211.6	949.7	1162.6	0.3595	1.7089	15.17
28	13.3	246.4	213.7	948.3	1163.3	0.3625	1.7060	14.67
29	14.3	248.4	215.7	947.0	1164.0	0.3654	1.7032	14.19
30	15.3	250.3	217.6	945.6	1164.6	0.3682	1.7004	13.73
31	16.3	252.2	219.5	944.3	1165.2	0.3709	1.6977	13.31
32	17.3	254.0	221.3	943.1	1165.8	0.3735	1.6952	12.93
33	18.3	255.8	223.1	941.9	1166.4	0.3760	1.6928	12.56
34	19.3	257.6	224.9	940.7	1167.0	0.3785	1.6905	12.21
35	20.3	259.3	226.6	939.6	1167.6	0.3809	1.6883	11.89
36	21.3	260.9	228.2	938.5	1168.2	0.3833	1.6860	11.58
37	22.3	262.5	229.8	937.4	1168.8	0.3856	1.6838	11.29
38	23.3	264.1	231.4	936.4	1169.4	0.3879	1.6817	11.02
39	24.3	265.7	232.9	935.4	1170.0	0.3901	1.6796	10.76

STEAM TABLES *(contd.)*

Abs. p. lbs. per sq. in.	Vacuum inches	Temp. °F.	Heat in Mean British Thermal Units per lb. from 32°F.			Entropy. Ranks per lb.		Volume. cu. ft. per lb. Dry Sat.
			Water, total heat	Latent heat of vaporisation	Steam, total heat	Water	Steam	
40	25.3	267.2	234.4	934.4	1170.5	0.3923	1.6776	10.50
42	27.3	270.3	237.4	932.3	1171.4	0.3964	1.6737	10.03
44	29.3	273.1	240.3	930.3	1172.3	0.4003	1.6700	9.600
46	31.3	275.8	243.0	928.3	1173.2	0.4041	1.6664	9.209
48	33.3	278.5	245.7	926.4	1174.0	0.4077	1.6630	8.848
50	35.3	281.0	248.2	924.6	1174.8	0.4112	1.6597	8.516
52	37.3	283.5	250.7	922.9	1175.6	0.4146	1.6566	8.208
54	39.3	285.9	253.1	921.1	1176.3	0.4179	1.6536	7.922
56	41.3	288.3	255.4	919.4	1177.0	0.4211	1.6507	7.656
58	43.3	290.5	257.7	917.8	1177.7	0.4242	1.6478	7.407
60	45.3	292.7	259.8	916.2	1178.4	0.4272	1.6450	7.175
62	47.3	294.9	262.0	914.6	1179.0	0.4302	1.6423	6.957
64	49.3	296.9	264.0	913.1	1179.6	0.4331	1.6398	6.752
66	51.3	299.0	266.1	911.6	1180.2	0.4359	1.6374	6.560
68	53.3	301.0	268.1	910.1	1180.8	0.4386	1.6350	6.378
70	55.3	302.9	270.0	908.7	1181.4	0.4412	1.6327	6.206
72	57.3	304.8	271.9	907.4	1182.0	0.4437	1.6304	6.044
74	59.3	306.7	273.8	906.0	1182.5	0.4462	1.6282	5.890
76	61.3	308.5	275.6	904.6	1183.0	0.4486	1.6261	5.743
78	63.3	310.3	277.4	903.2	1183.5	0.4510	1.6240	5.604
80	65.3	312.0	279.0	901.9	1184.0	0.4533	1.6219	5.472
82	67.3	313.7	280.7	900.6	1184.5	0.4556	1.6199	5.346
84	69.3	315.4	282.4	899.4	1185.0	0.4579	1.6180	5.226
86	71.3	317.1	284.1	898.1	1185.4	0.4601	1.6161	5.110
88	73.3	318.7	285.7	896.8	1185.8	0.4622	1.6142	5.000
90	75.3	320.3	287.3	895.5	1186.2	0.4643	1.6124	4.896
92	77.3	321.9	288.9	894.3	1186.6	0.4664	1.6106	4.796
94	79.3	323.3	290.3	893.1	1187.0	0.4684	1.6088	4.699
96	81.3	324.8	291.8	891.9	1187.4	0.4704	1.6071	4.607
98	83.3	326.3	293.3	890.8	1187.8	0.4723	1.6054	4.519
100	85.3	327.8	294.8	889.7	1188.2	0.4742	1.6038	4.434
105	90.3	331.3	298.3	886.9	1189.1	0.4789	1.6000	4.230
110	95.3	334.8	301.8	884.2	1189.9	0.4833	1.5963	4.046
115	100.3	338.1	305.1	881.5	1190.7	0.4876	1.5927	3.880
120	105.3	341.3	308.3	878.9	1191.4	0.4918	1.5891	3.729
125	110.3	344.4	311.4	876.4	1192.1	0.4958	1.5856	3.587
130	115.3	347.3	314.3	874.0	1192.8	0.4997	1.5823	3.456
135	120.3	350.2	317.1	871.5	1193.4	0.5035	1.5792	3.335
140	125.3	353.0	319.9	869.1	1194.0	0.5071	1.5762	3.222
145	130.3	355.8	322.7	866.8	1194.6	0.5106	1.5733	3.116
150	135.3	358.4	325.3	864.5	1195.1	0.5140	1.5705	3.015
155	140.3	361.0	327.9	862.3	1195.6	0.5173	1.5678	2.922
160	145.3	363.6	330.5	860.1	1196.1	0.5205	1.5652	2.835
165	150.3	366.0	332.9	858.0	1196.6	0.5236	1.5627	2.754
170	155.3	368.4	335.3	855.9	1197.1	0.5267	1.5602	2.677

STEAM TABLES *(contd.)*

Abs. p. lbs. per sq. in.	Vacuum inches	Temp. °F.	Heat in Mean British Thermal Units per lb. from 32°F.			Entropy. Ranks per lb.		Volume. cu. ft. per lb. Dry Sat.
			Water, total heat	Latent heat of vaporisation	Steam, total heat	Water	Steam	
175	160.3	370.8	337.7	853.9	1197.6	0.5297	1.5578	2.603
180	165.3	373.1	340.0	851.9	1198.0	0.5326	1.5554	2.534
185	170.3	375.3	342.2	849.9	1198.4	0.5355	1.5531	2.468
190	175.3	377.5	344.3	847.9	1198.8	0.5383	1.5509	2.407
195	180.3	379.7	346.5	846.0	1199.2	0.5410	1.5487	2.347
200	185.3	381.8	348.6	844.0	1199.5	0.5437	1.5466	2.290
205	190.3	383.9	350.7	842.0	1199.8	0.5463	1.5445	2.237
210	195.3	385.9	352.7	840.1	1200.1	0.5488	1.5424	2.185
215	200.3	387.9	354.7	838.3	1200.4	0.5513	1.5404	2.136
220	205.3	389.9	356.7	836.5	1200.7	0.5537	1.5384	2.089
225	210.3	391.8	358.6	834.8	1201.0	0.5562	1.5366	2.042
230	215.3	393.7	360.5	833.0	1201.3	0.5587	1.5347	1.999
235	220.3	395.5	362.4	831.2	1201.5	0.5611	1.5329	1.958
240	225.3	397.4	364.2	829.4	1201.7	0.5634	1.5311	1.918
245	230.3	399.2	366.0	827.7	1201.9	0.5656	1.5293	1.880
250	235.3	401.0	367.8	826.0	1202.1	0.5677	1.5276	1.844
260	245.3	404.4	371.2	822.6	1202.5	0.5721	1.5243	1.775
270	255.3	407.8	374.5	819.3	1202.9	0.5762	1.5211	1.711
280	265.3	411.1	377.8	816.1	1203.2	0.5803	1.5179	1.651
290	275.3	414.2	380.9	812.9	1203.5	0.5843	1.5148	1.595
300	285.3	417.3	384.0	809.8	1203.8	0.5881	1.5117	1.543
310	295.3	420.4	387.0	806.8	1204.1	0.5918	1.5088	1.494
320	305.3	423.3	390.0	803.7	1204.3	0.5954	1.5060	1.448
330	315.3	426.2	392.9	800.7	1204.5	0.5990	1.5032	1.405
340	325.3	429.0	395.7	797.8	1204.7	0.6024	1.5005	1.364
350	335.3	431.7	398.4	795.0	1204.9	0.6058	1.4979	1.326
360	345.3	434.4	401.1	792.3	1205.1	0.6092	1.4953	1.289
370	355.3	437.0	403.6	789.5	1205.2	0.6124	1.4928	1.255
380	365.3	439.6	406.2	786.7	1205.3	0.6155	1.4904	1.222
390	375.3	442.1	408.7	784.0	1205.4	0.6186	1.4880	1.191
400	385.3	444.6	411.2	781.3	1205.5	0.6216	1.4857	1.161
410	395.3	447.0	413.7	778.6	1205.5	0.6245	1.4834	1.133
420	405.3	449.4	416.0	775.9	1205.5	0.6274	1.4811	1.106
430	415.3	451.7	418.3	773.3	1205.5	0.6303	1.4789	1.080
440	425.3	454.0	420.6	770.8	1205.6	0.6331	1.4767	1.056
450	435.3	456.3	422.9	768.2	1205.6	0.6358	1.4746	1.032
460	445.3	458.5	425.1	765.7	1205.6	0.6385	1.4725	1.009
470	455.3	460.7	427.3	763.2	1205.6	0.6412	1.4705	0.988
480	465.3	462.8	429.3	760.7	1205.5	0.6438	1.4685	0.967
490	475.3	464.9	431.4	758.3	1205.5	0.6464	1.4665	0.947
500	485.3	467.0	433.6	755.8	1205.4	0.6489	1.4646	0.928
550	535.3	476.9	443.5	743.9	1204.9	0.6614	1.4553	0.843
600	585.3	486.2	452.7	732.4	1204.2	0.6722	1.4466	0.770
700	685.3	503.1	469.5	710.5	1202.2	0.6927	1.4308	0.655
800	785.3	518.2	484.6	689.7	1199.6	0.7110	1.4165	0.569

DANKS *of* NETHERTON *Ltd.*, NETHERTON · DUDLEY WORCS.

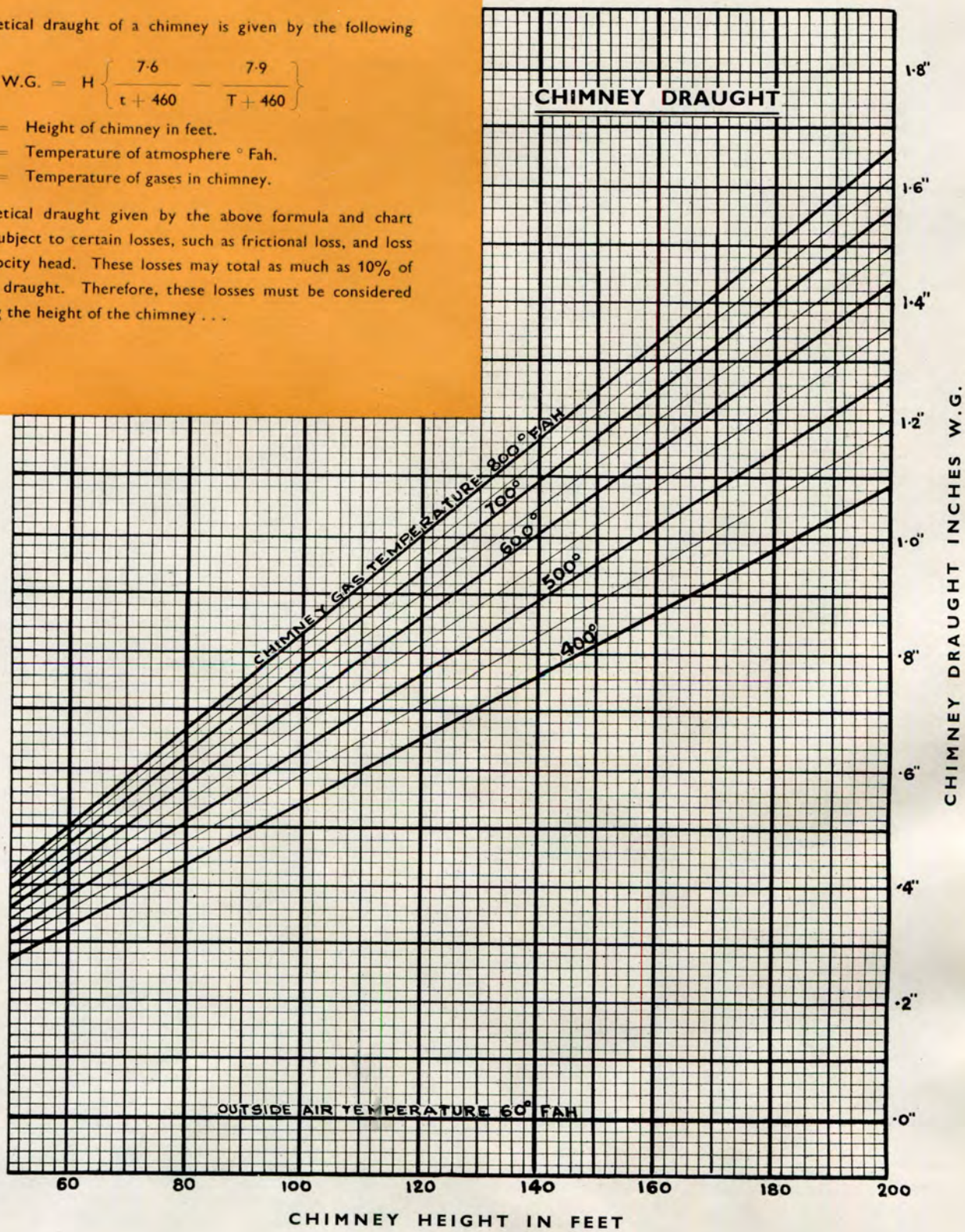
CHIMNEYS *for* BOILER PLANTS

The theoretical draught of a chimney is given by the following formula :

$$\text{Inches W.G.} = H\left\{\frac{7{\cdot}6}{t+460} - \frac{7{\cdot}9}{T+460}\right\}$$

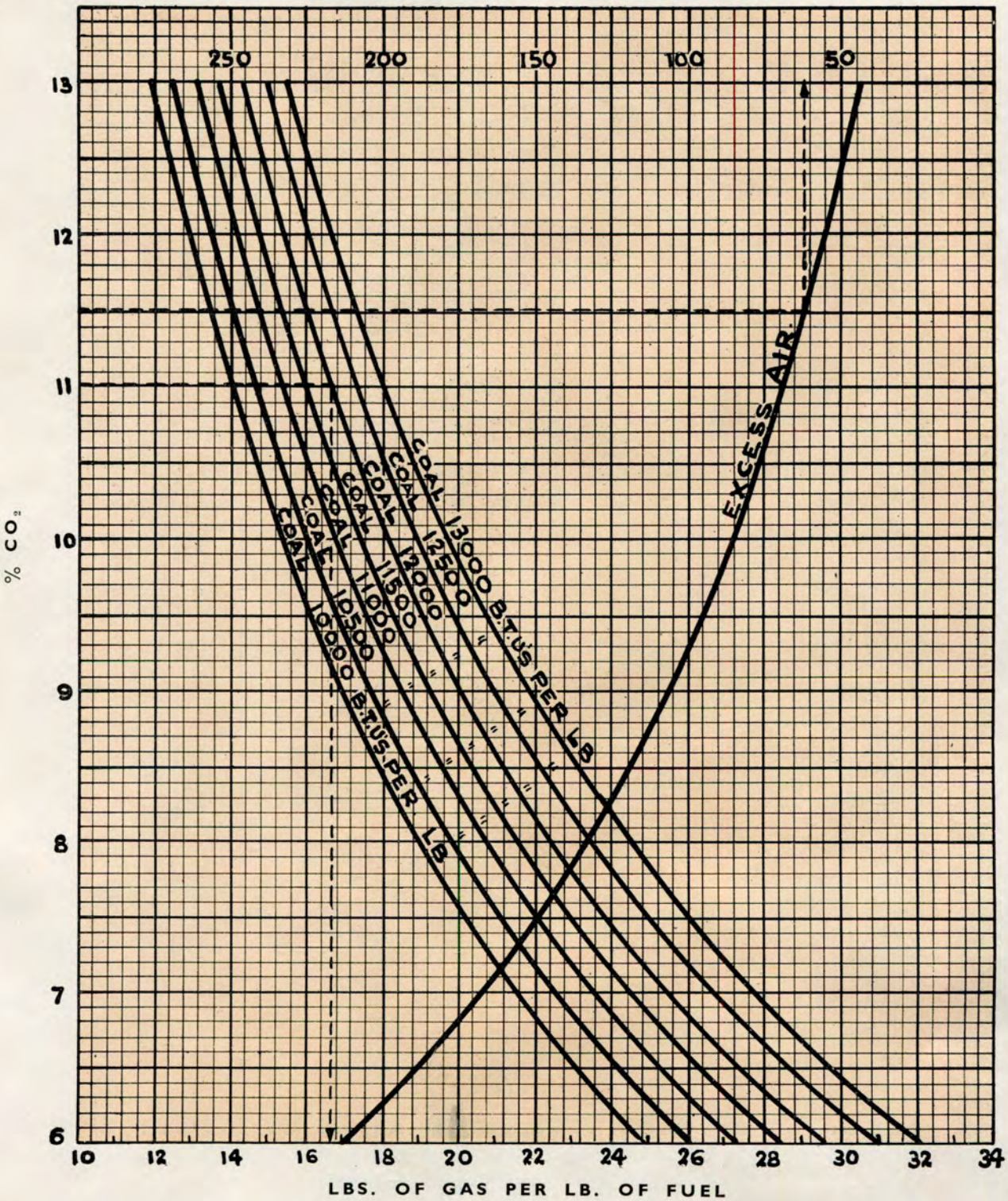
Where H = Height of chimney in feet.
t = Temperature of atmosphere ° Fah.
T = Temperature of gases in chimney.

The theoretical draught given by the above formula and chart below, is subject to certain losses, such as frictional loss, and loss due to velocity head. These losses may total as much as 10% of theoretical draught. Therefore, these losses must be considered when fixing the height of the chimney . . .



DANKS *of* NETHERTON *Ltd.*, NETHERTON · DUDLEY WORCS.

CHART SHOWING LBS. OR GAS PER LB. OF FUEL AND PERCENTAGE OF EXCESS AIR



DANKS of NETHERTON Ltd. NETHERTON · DUDLEY WORCS.

ENGLISH AND METRIC EQUIVALENTS

1 inch	=	25·4 millimeters.
1 foot	=	0·305 metre.
1 yard	=	0·914 metre.
1 sq. inch	=	6·451 sq. centimetres.
1 sq. foot	=	0·093 sq. metre.
1 sq. yard	=	0·836 sq. metre.
1 cu. inch	=	16·387 cu. centimetres.
1 cu. foot	=	0·028 cu. metre.
1 cu. yard	=	0·764 cu. metre.
1 lb.	=	0·454 kilogrammes.
1 millimetre	=	0·039 inches.
1 centimetre	=	0·3937 inches.
1 metre	=	39·37 inches.
1 sq. centimetre	=	0·155 sq. inch.
1 sq. metre	=	10·76 sq. ft.
1 cu. centimetre	=	0·061 cu. in.
1 cu. metre	=	35·3 cu. ft. or 1·31 cu. yd.
1 kilogramme	=	2·2 lb.
1 metric ton (1,000 kg.)	=	2204·7 lb.
1 lb. per sq. in.	=	0·07031 kilo per sq. cm.
1 lb. per sq. ft.	=	4·88 kilo. per sq. metre.
1 kilo. per sq. cm.	=	14.223 lb. per sq. in.
1 kilo. per sq. metre	=	0·205 lb. per sq. ft.
1 B.Th.U.	=	0·252 calories.
1 B.Th.U. per sq. ft.	=	2·713 calories per sq. metre.
1 B.Th.U. per lb.	=	0·555 calorie per kilo.
1 Calorie	=	3·968 B.Th.U.
1 Calorie per sq. metre	=	0·368 B.Th.U. per sq. ft.
1 Calorie per kilo.	=	1·8 B.Th.U. per lb.
1 Atmos.	=	14·7 lb. per sq. in.
1 Imperial gallon	=	10 lb. or 0·16 cu. ft. 277·274 cu. in. 4·543 litres.
1 cu. ft. of water	=	62.32 lb.
1 cu. in. of water	=	0·036 lb.
1 lb. of water	=	27·72 cu. in.
1 ft. head of water	=	0·434 lb. per sq. in.
Degs. F.	=	(Degs. C. $\times \frac{9}{5}$) + 32.
Degs. C.	=	(Degs. F. — 32) $\times \frac{5}{9}$.

DANKS of NETHERTON Ltd., NETHERTON · DUDLEY WORCS.